Supreme Court, U. S.
FILED
AUG 16 1978
MICHAEL RODAK, JR., CLE

IN THE

Supreme Court of the United States

October Term, 1977

No. 78-263

EUTECTIC CORPORATION,
NEW METALS CORPORATION, and
METALLIZING COMPANY OF AMERICA, INC.,

Petitioners,

v.

METCO, INC.,

Respondent.

PETITION FOR WRIT OF CERTIORARI TO THE UNITED STATES COURT OF APPEALS FOR THE SECOND CIRCUIT

JOHN M. CALIMAFDE
Attorney for Petitioners
60 East 42nd Street
New York, New York 10017

Of Counsel:
EUGENE J. KALIL
MARVIN N. GORDON
HOPGOOD, CALIMAFDE, KALIL,
BLAUSTEIN & LIEBERMAN
60 East 42nd Street
New York, New York 10017

TABLE OF CONTENTS

	PAGE
Opinions Below	1
Jurisdiction	2
Questions Presented	2
Constitutional and Statutory Provisions Involved	2
Statement of the Case	2
A. The Facts	2
B. The Opinions Below	4
The District Court	4
The Second Circuit	7
Reasons for Granting the Writ	8
A. In Summary	8
B. Summary Argument	8
Conclusion	12
Appendices:	
A—Opinion of United States District Judge Edward Neaher	A1
B—Opinion of the United States Court of Appeals for the Second Circuit	A62
C—Section 8, Clause 8. Patents and Copyrights	A74
D—§103. Conditions for Patentability; Non-Obvious Subject Matter	A75
§112. Specification	A75

TABLE OF AUTHORITIES

PAGE

Cases:

General Electric Co. v. Wabash Co., 304 U.S. 364 (1938), 58 S.Ct. 899, 902 9

Graham v. John Deere Co., 383 U.S. 1 (1966), 86 S.Ct. 684 at 688 ..... 7, 11

Great Atlantic & Pacific Tea Company v. Supermarket Equipment Corporation, 340 U.S. 147 (1950) 71 S.Ct. at 127-129 ..... 9, 10

Lyon v. Roh, 1 F.2d 48 (S.D.N.Y. 1924) 6

Plantronics, Inc. v. Roanwell Corp., 535 F.2d 1397 (2 Cir. 1976), cert. den. 97 S.Ct. 538 ..... 10, 11

Timely Products Corporation v. Arron, 403 F.Supp. 138, 148; 523 F.2d 288 (2 Cir. 1975) 10, 11

United Carbon Co. v. Binney & Smith Co., 317 U.S. at 228 (1942), 63 S.Ct. 165 at 170 9

U.S. Philips Corp. v. National Micronetics, Inc., et al., 550 F.2d 716 (2 Cir. 1976) 10, 11

White v. Dunbar, 119 U.S. 47, 51-52 (1886) 9

IN THE

Supreme Court of the United States

October Term, 1977

No. .....

EUTECTIC CORPORATION, NEW METALS CORPORATION, and METALLIZING COMPANY OF AMERICA, INC.,
Petitioners,

v.

METCO, INC.,
Respondent.

PETITION FOR WRIT OF CERTIORARI TO THE UNITED STATES COURT OF APPEALS FOR THE SECOND CIRCUIT

Petitioners, Eutectic Corporation, New Metals Corporation, and Metallizing Company of America, Inc., pray that a Writ of Certiorari issue to review the judgment of the United States Court of Appeals for the Second Circuit.

Opinions Below

The Opinion of the Second Circuit Court of Appeals is not officially reported, but is reprinted as Appendix B to this Petition. The opinion of the District Court for the Eastern District of New York is reported at 418 F.Supp. 1186 and is reprinted as Appendix A.

Jurisdiction

The judgment of the Court of Appeals was entered on February 6, 1978. A timely petition for rehearing and suggestion for rehearing *en banc* were denied on May 17, 1978. The judisdiction of this Court is invoked under 28 U.S.C. §1254(1).

Questions Presented

1. After finding that the patent claims as worded were anticipated and invalid, did the court below err in reading validating elements into the claims?

2. Did the Second Circuit err in holding that the patents at issue were not invalid for obviousness (35 U.S.C. 103), on the asserted grounds that the "invention" solved a problem, despite the holdings of this Court?

Constitutional and Statutory Provisions Involved

This case involved Art. I, Section 8, Clause 8 of the Constitution (App. C); and Sections 103 and 112 of the Patent Act of 1952, 35 U.S.C. 103 and 112 (App. D).

Statement of the Case

A. The Facts

This action for declaratory judgment of patent invalidity and noninfringement was brought on January 24, 1972, by petitioners Eutectic Corporation, New Metals Corporation and Metallizing Company of America, Inc.,

in the United States District Court for the Eastern District of New York. Respondent, Metco, Inc., counterclaimed for patent infringement and sought an injunction and damages. Jurisdiction was founded on 28 U.S.C. 1338(a). Petitioners seek review of the decision of the Court of Appeals for the Second Circuit, which reversed the judgment of the District Court, holding valid and infringed certain claims of U.S. Patents Nos. 3,322,515 (the '515 patent) and 3.436,248 (the '248 patent); the District Court held the patents valid but not infringed.

The patents are directed to the pairing of two metals, e.g., nickel and aluminum, prepared for spraying by a flame spray gun onto a metal surface, much as paint is sprayed. The '515 patent covers the flame spray powders, and the '248 patent covers the admittedly conventional process of spraying the materials described in the '515 patent.

The pairs are selected so that when they are made molten by the flame, they react to form an intermetallic compound (i.e., a compound of the two metals), and in so reacting generate additional heat. When two metals react and thereby generate heat, the reaction is called "exothermic." Metal pairs which react exothermically have been well known long before the patents in suit, and their identification is readily available in metallurgical handbooks. Specifically, the patents cover 142 pairs, all of which have been copied out of a standard handbook; the handbook also discloses the compounds resulting from the interaction between the metals of each pair when the metals are made molten and react together. Thus, the component pairs, the nature of the reaction and the resultant compound was common knowledge available to the public.

The only difference between the information contained in the handbook and the patents in suit is that the handbook did not expressly state that the metal pairs may be used as a flame spray powder. The '515 patent which covers the powder prepared for flame spraying, requires that the metal particles of the pair be attached or pasted to each other; the patents refer to this arrangement of particles as a "composite."

Petitioners make a flame spray powder consisting of nickel and aluminum, a pair selected from the handbook and covered by the patents at issue.

The basic claim (claim 14) of the '515 patent reads as follows:

> "A flame spray powder in the form of individual clad particles comprising a nucleus of nickel and a coating layer of finely divided aluminum particles bound to the nucleus with a binder and characterized by the ability of generating heat during flame spraying which aids in bonding to the surface being sprayed."

The claim does not specify any particular proportion of the nickel to aluminum, nor does it specify that the particles shall be in composite arrangement.

B. The Opinions Below

The District Court

The District Court held that the key to the generation of heat was to be found in the percentage relationship of the nickel and aluminum components, and in the composite arrangement of the particles, neither of which is spelled out in the claims in issue (A. 51). The examples in the

patent specification teach at least 15 weight percent of aluminum and 85 weight percent nickel; a proportion which the Trial Judge found went "to the *very heart* of [respondent's] claimed invention." (A. 50).*

Because the percentage relationship of the particles was found critical to the generation of heat resulting from the formation of the intermetallic compound, the District Court held that the claims,

> "* * * *cannot be read literally without destroying the essence of the invention claimed.* The invention did not consist of pasting smaller particles of aluminum powder on larger particles of nickel powder. Indeed, the patentees were denied a patent they sought on [such] process * * *. If binding particles of different metals together with an adhesive film was all there was to the patentees' invention, claim 14 would clearly have been *anticipated* and *invalid.* But, as already noted, and stressed by the patentees throughout prosecution, the *critical factor* and *essence* of the invention was the predetermined relationship between the component metals which * * * generated surplus heat through the *formation of an intermetallic compound,* thereby enabling the sprayed material to bond to the substrate." (A. 51).

Thus, the District Court found that claim 14 was anticipated and invalid if read literally.** He, thereupon, read into the claim the essential validating element of the critical percentage of aluminum that is required to react with nickel to produce the intermetallic compound (A. 53).

---

* The Court also found that respondent's own powder did not conform to the specified percentage relationship (A. 50). Italicizing in quotes throughout brief unless otherwise specified.

** The Court of Appeals agreed with such determination (A. 68).

Less than the critical amount of aluminum in the mixture results in the aluminum burning-off and generating heat in an exothermic reaction called "oxidation" of aluminum. The use of aluminum in flame spray powders for the purpose of producing an exothermic reaction and generating additional heat by oxidation was known in the prior art. Indeed, the Patent Examiner rejected the patent applications several times* because of this well-known property of aluminum in prior art flame spray powders. The patents were eventually allowed because respondent was successful in distinguishing between the prior art oxidation of aluminum and the intermetallic reaction between aluminum and nickel.

The petitioners' powder used only 5% by weight of aluminum, which the Trial Court found was too small an amount to form an intermetallic, but which oxidized in the flame as taught by the prior art (A. 55, 56).

Thus, the facts and findings of the Trial Judge left no doubt that:

1. The claims on their face were anticipated and invalid;

2. Critical validating elements had to be implied into the claims; specifically, the minimum percentage of aluminum required to produce the intermetallic;

* The patents in suit are a result of five re-filings of the applications, after repeated rejections by the Examiner, and finally wearing the examiner down. Judge Learned Hand's comment in *Lyon* v. *Boh*, 1 F.2d 48 (S.D.N.Y. 1924), regarding the "ant-like persistency" of solicitors wearing the examiner down, is particularly *appropos* here.

3. Less than the minimum percentage of aluminum in the flame spray mixture resulted in a reaction disclosed in the prior art;

4. Petitioners' powder used only 5% aluminum which amount was insufficient to produce an intermetallic, and the aluminum burned-off by oxidation as in the prior art powders.

The Second Circuit

The Second Circuit, despite repeated admonishments by this Court that patentability is not to be determined by secondary considerations such as "problem," "commercial success" and the like, sustained the patents essentially by applying the "problem test" (A. 64-67). The Circuit Court never applied the basic *Graham** tests, *infra*, and never addressed itself to the finding by the Trial Judge that the claims as worded were invalid. If the Circuit Court had applied the basic *Graham* tests, it would have compared the claims with the prior art and as stated by the Trial Judge would have found the claims anticipated. Under the mandate of this Court, it should then have found the patents invalid.

The plain fact of the matter is that the decision below secures to respondent a monopoly of indeterminable scope and incalculable effect, embracing the use of the admittedly old aluminum oxidation process, based upon patents which are clearly in violation of this Court's standards.

* *Graham* v. *John Deere Co.*, 383 U.S. 1 (1966).

Reasons for Granting the Writ

A. In Summary

Petitioners respectfully submit that this Court should review the present case because:

1. The decision applying the "problem test" of patentability is clearly in conflict with the rulings of this Court with respect to the construction of the patents clause of the Constitution (Art. I, §8, Cl. 8); and the standards for determining the validity and scope of a patent monopoly.

2. The decision below validates a patent on a basis which is not specified or disclosed in the claims. This decision is in conflict with the conclusions of this Court, and it opens a potentially explosive area of patent adjudication.

3. The issues are of great importance to the administration of the patent laws and to the national interest in the preservation of an open, competitive society in which access to the fund of knowledge is not interfered with beyond the strict limits of the Constitution as construed by this Court.

B. Summary Argument

1. *Conflict With Decisions Of This Court*

(a) *Viewed in light of this Court's prior decisions, patent claims may not be treated as a "nose of wax which may be turned and twisted in any direction, by merely referring to the specification, so as to make it include something more than, or something different from, what its*

words express." *White* v. *Dunbar*, 119 U.S. 47, 51-52 (1886). The Trial Judge expressly stated that the claims, read literally, were "anticipated and invalid." The Second Circuit agreed with the Trial Judge's reasoning. Thus, under the *Dunbar* rule of this Court, the claims are invalid and may not be validated by reading critical elements into the claim as the Trial Judge acknowledged he was required to do.

(1) *The lower courts sustained the validity of the claims on the basis of reading into the claims specific component proportions capable of forming an intermetallic compound—which are not asserted in the claims.* A patent may not be validated by features not specified in the claims. 35 U.S.C. 112; *United Carbon Co.* v. *Binney & Smith Co.*, 317 U.S. at 228 (1942), 63 S.Ct. 165 at 170. The scope of protection granted by a patent is defined by the language of its claims, and it is the "claims which define the boundaries of a patent monopoly." *Great Atlantic & Pacific Tea Co.* v. *Supermarket Equip. Corp.*, 340 U.S. 147 (1950), 71 S.Ct. at 128. It is the claims and only the claims which "measure the invention." *General Electric Co.* v. *Wabash Co.*, 304 U.S. 364 (1938), 58 S.Ct. 899, 902.

(b) *Viewed in light of this Court's prior decisions, the patents are invalid for lack of invention and for obviousness.*

(1) The Second Circuit has adopted the novel and impermissible "existence of a problem" test for determining patentability. We respectfully submit that a reading of opinions in other Courts of Appeals

involving questions of patentability underscores the need for this Court to review the present case, and to affirm and reaffirm the constitutional and statutory standards which should be applied in all patent adjudications.

For examples of the Second Circuit's departure from this Court's precepts, see *Timely Products Corporation* v. *Arron,* 523 F.2d 288 (2 Cir. 1975), which gave rise to the "problem" test of patentability in dictum reading: "We can conceive of no better way to determine whether an invention would have been obvious" than to apply the "problem" test. This Court had since the *A & P* case in 1950 prescribed the better way, and in *Graham* v. *John Deere Co.,* 383 U.S. 1 (1966), specifically articulated the primary tests as the better way.

The Circuit's opinion in *Timely Products* was written by District Judge Conner, sitting in the Second Circuit by designation. Judge Conner, a former patent attorney, in an article published in the American Patent Law Association, 5 APLA Journal 77-86 (1977), states that he wrote the relevant portion of *Timely Products* for the specific purpose of *challenging* this Court's decisions that "secondary considerations" of long-felt need, commercial success and problem-solving do not establish "invention" and "non-obviousness"; and he notes with satisfaction that the Second Circuit has followed his lead in *Plantronics, Inc.* v. *Roanwell Corp.,* 535 F.2d 1397 (2 Cir. 1976), cert. den. 97 S.Ct. 538, and in *U.S. Philips Corp.* v. *National Micronetics Inc. et al.,* 550 F.2d 716 (2 Cir. 1976). This case is the latest in the series emerging from the Second Circuit

using the problem-test formula in determining patentability.

The principle at issue is clear. The patents are concededly a combination of prior art. The Second Circuit decision confined itself essentially to the "secondary considerations" of the alleged existence of a problem which the patented composition "solved" (A. 64-67).

In his article, Judge Conner candidly discloses that the purpose and thrust of the *Plantronics* case and the *Philips* case is to depart from *Graham,* and subsequent decisions of this Court. Their purpose and effect is to convert the "secondary considerations" into the dispositive test of invention and non-obviousness. As Mr. Justice White stated (97 S.Ct. at 541, citing prior decisions of this Court), this Court "has consistently and repeatedly rejected the claim that the [constitutional] standard of invention or [the statutory requirement of] non-obviousness can be satisfied solely by these 'objective' criteria."

The validity issue in this case is plain: it is presented by the Second Circuit's adherence to the problem-solving principle of *Timely Products* and its attempted exaltation of "secondary considerations" to primary and conclusive bases of patentability. The issue presented is of basic importance to patent law to our constitutional and economic system of open-enterprise. The Second Circuit is a major forum. Its decision in the present case is not isolated or a "sport"; this is the fourth recent case in which the present issue figures. And the present decision is likely to be followed in other circuits.

We respectfully submit that the Court should put an end to the forum-shopping which these conflicts have in-

vited, and should terminate the situation in which patent validity, access to knowledge, and the survival of competitors depends upon the choice of forum.

Conclusion

For the reasons stated, a writ of certiorari should issue to review the judgment and opinion of the United States Court of Appeals for the Second Circuit.

Respectfully submitted,

JOHN M. CALIMAFDE
Attorney for Petitioners
60 East 42nd Street
New York, New York 10017

Of Counsel:
EUGENE J. KALIL
MARVIN N. GORDON
HOPGOOD, CALIMAFDE, KALIL,
BLAUSTEIN & LIEBERMAN
60 East 42nd Street
New York, New York 10017

Appendices

Appendix A

Opinion of United States District Court
Neaher, District Judge

DISTRICT COURT

E. D. NEW YORK

EUTECTIC CORPORATION, *et al.*

v.

METCO, INC.

No. 72 C 102 Decided July 13, 1976

This action, which was tried by the court on the facts, involves questions of validity and infringement of United States Patent 3,322,515 (the '515 patent) and United States Patent 3,436, 248 (the '248 patent) owned by defendant Metco, Inc. The action was begun by plaintiffs as a declaratory judgment action, requesting a declaration of non-infringement and invalidity of the patents. Defendant counterclaimed, charging infringement by each plaintiff. Jurisdiction is grounded on the patent laws of the United States, 28 U.S.C. §1338.

Preliminary Statement

Plaintiff Eutectic Corporation ("Eutectic") and plaintiff New Metals Corporation ("New Metals"), its wholly-owned subsidiary, are New York corporations, having their

principal place of business in Flushing, New York. Plaintiff Metallizing Company of America ("Metallizing"), a customer of Eutectic, is an Illinois corporation having its principal place of business in Chicago, Illinois. Defendant Metco, Inc. ("Metco") is a Delaware corporation having its principal place of business in Westbury, New York.

Eutectic, since its founding in 1940, has been engaged in developing, manufacturing and marketing special alloys, torch equipment and other consumable products utilized in the soldering, brazing and welding field. In 1970 Eutectic announced the development of a new exothermic nickel-aluminum powder tradenamed "Exotec," which would eliminate the need for a subsequent fusing operation in order to bond a metal coating using Eutectic's "Spram" process for spray welding applications in the glass mold industry. Subsequently, Eutectic developed its own "Roto-Tec" flame spray process based upon Exotec and added "Durotec" and "Xuper-Bond" powders to its product line. All of these products are basically nickel-aluminum compositions.

Metco has been in the business of manufacturing and selling metallizing and flame spraying equipment and providing related materials and technical services since before 1938. It claims that Eutectic's Exotec, Durotec and Xuper-Bond products are infringing copies of a series of nickel-aluminum self-bonding flame spray powders Metco had developed about 1960, and which it had begun successfully marketing in 1963, subsequent to the filing of the patent application that eventually led to the issuance of the '515 and '248 patents on the Metco powders and process.

Metco originally commenced this litigation in the Northern District of Illinois[1] against Metallizing because of the latter's sale of a product called "Moguloy M-55", which Metco claims also infringes the patents in suit. Metallizing has been in the flame spray field since the 1920's and had previously marketed a Metco-patented molybdenum flame spray material hereinafter mentioned. Moguloy M-55 was Metallizing's first venture into nickel-aluminum powder, a product manufactured by Eutectic which Metallizing purchased through Eutectic's subsidiary, New Metals.

Plaintiffs challenge the validity of the Metco patents on a variety of grounds: (1) the claimed invention was fully anticipated by prior patents; (2) the use of composite nickel-aluminum powder for flame spraying as described in the patents would have been obvious to one having ordinary skill in the art, and Metco's employees simply obtained a patent on coated powders purchased from a producer of such materials; and (3) the '515 patent claims merely an unpatentable new "use" for a known material, and the '248 patent an admittedly conventional process for spraying the material covered by the '515 patent. Plaintiffs also deny infringement, claiming that the Eutectic powders, including Moguloy M-55, are different from Metco's products and not covered by the literal terms of the patents.

The Industrial Art Involved

The patents in suit relate to the industrial technique of flame spraying, formerly known as metallizing. Flame spraying is a process for applying a metal, a ceramic (metal

1. See Eutectic Corporation v. Metco, Inc., 346 F.Supp. 845, 174 USPQ 25 (E.D.N.Y. 1972).

oxide), or a mixed metal/ceramic (cermet) coating in a molten state to another metal surface (also called substrate) to form a bond between the two that will permit the coated surface (or object) to undergo further finishing operations, resist corrosion, or withstand high temperatures or other wear and stress during use. The coating to be sprayed on the substrate is commonly referred to as "flame spray material." The flame spray material, which may be in rod, wire or powder form, is fed into a device called a "flame spray gun." As the flame spray material passes through the gun it is reduced by gas-oxygen or electric arc flame to a molten or semi-molten state and propelled in atomized form onto the surface to be coated, much as paint is sprayed.

From the original development of flame spraying about the turn of the century until the 1940's, the only practicable method of assuring some degree of adhesion (bond strength) between a flame spray coating and a metal surface was to mechanically roughen the surface by grit blasting, cutting threads and the like, so as to provide crevices or undercuts into which the sprayed molten particles would enter, forming a mechanical interlock. The first commercial utilizations of flame spraying were in connection with relatively low melting point metals sprayed through a wire gun in order to produce corrosion-resistant and decorative metal coatings. It was during this period that the process was known as "metallizing."

Although improvements were subsequently made in metallizing guns and materials and the mechanical treatment of surfaces, no significant commercial development

occurred until the mid-1940's when Arthur P. Shepard, a Metco engineer and deceased co-patentee of the patents in suit, discovered the self-bonding properties of molybdenum as a flame spray material. He found that molybdenum, when prepared in wire form and sprayed onto a clean unroughened surface, would self-bond to form a base coating with a high bond strength (about 2,000 psi), to which subsequently applied flame spray materials would also tenaciously adhere. Shepard was granted U.S. Patent 2,588,421 on that discovery, and molybdenum wire remained the only known and widely used self-bonding material in the flame spray field for almost 15 years.

Molybdenum wire, despite its commercial success, had a number of disadvantages. It was difficult and messy to use; caused wear on equipment because of its hardness; could only be applied at a relatively slow spray rate; would not satisfactorily bond to copper, copper alloy, or nitrided surfaces; required a high degree of operator skill for satisfactory application; and could not be used where the part being sprayed would subsequently be subjected to use at temperatures above 600°. At such temperatures, the molybdenum would oxidize and deteriorate, destroying the bond. Efforts to overcome some of these problems by attempting to spray molybdenum in powder form were not successful.

It is Metco's claim in this action—sharply controverted by plaintiffs—that another Metco engineer, Ferdinand J. Dittrich, working under Shepard, made the next important advance in the art which resulted in the patents in suit. This took the form of a self-bonding flame spray powder of nickel-aluminum composite granules which Metco orig-

inally introduced as "Metco 404" in 1964, while the patent applications were pending. Metco aserts the new powder overcame practically all the disadvantages of molybdenum wire, was widely accepted in the flame spray field as replacing molybdenum to a large extent, and has enjoyed great commercial success.

The Patents and Claims in Issue

Metco's '515 patent issued to Dittrich and Shepard on May 30, 1967, on an application filed March 25, 1965 as a continuation-in-part of earlier applications dating back to November 22, 1960, and is directed to a product, a flame spray material in powder or wire form. The '248 patent to the same patentees issued on April 1, 1969 on an application filed May 26, 1966 as a division of the application resulting in the '515 patent. It is directed to a process of flame spraying the material disclosed in the '515 patent.[2] Both patents were later assigned to Metco by the patentees.

Claims 4 and 14 of the '515 patent and Claims 1 and 4 of the '248 patent, quoted in the margin, constitute the matter substantially in issue between the parties.[3] Those claims

2. Both patents bear the same caption "Flame Spraying Exothermically Reacting Intermetallic Forming Composites." Although the disclosure of the '248 patent appears to be identical with that of the '515 patent, it was required to be prosecuted by the Patent Office as an independent and distinct invention within 35 U.S.C. §121.

3. '515 Patent (PX 11)

"4. A flame spray material comprising a composite in a form suitable for flame spraying formed of aluminum and nickel and characterized by the ability of generating heat during flame spraying which aids in bonding to the surface being sprayed.

* * *

(footnote continued on next page)

teach the composition and process of spraying a flame powder of aluminum and nickel in composite form, which has the ability of generating additional heat in an exothermic reaction during spraying. It is that heat which is claimed to aid the resultant nickel aluminide coating to self-bond, i.e., adhere firmly, to smooth, clean metal surfaces as well as conventionally roughened surfaces.

A novel element claimed to contribute to the "unexpected" self-bonding results of the patented powder (or wire) is its "composite" form. The term "composite" in the patent designates not a mere mixture of powdered component metals but "a structurally integral unit" in which each granule of powder contains particles of nickel and aluminum bound in close contact with each other by a dry film binder.[4] The patent also describes a simplified method

"14. A flame spray powder in the form of individual clad particles comprising a nucleus of nickel and a coating layer of finely divided aluminum particles bound to the nucleus with a binder and characterized by the ability of generating heat during flame spraying which aids in bonding to the surface being sprayed."

'248 patent (PX 12)

"1. In the flame spray process in which a heat-fusible material is heated in a heating zone to at least heat-softened condition and propelled in such condition out of said zone in finely divided form onto a substrate, the improvement which comprises passing the heat-fusible material into said zone in the form of a composite comprising at least two distinct components unalloyed together as a single alloy and in proportion and form sufficient to exothermically react with each other at the temperature developed in the heating zone, forming an intermetallic compound.

* * *

"4. Improvement according to claim 1 in which one of said components is aluminum and the other nickel."

See PX 7, Prior Art Booklet, which reproduces both patents.

4. See PX 7, '515 patent, col. 2, lines 57-69, and Drawing Fig. 2.

of "cladding" the component metals so as to form the required composite.[5]

In sum, the patented invention under the claims in issue consists of the following elements: (a) a composite of powdered aluminum and nickel (b) each particle unit thereof comprising a nucleus of nickel clad with finely divided aluminum particles bound together by a resin binder, (c) capable of releasing heat of at least 7500 calories per gram atom in an exothermic reaction during flame spraying, (d) which produces an adherent self-bonded coating on a clean unheated and unroughened metal surface.

Plaintiffs do not question the utility of the flame spraying materials described in the claims in suit.[6] Their primary contention, simply stated, is that the patents are invalid because they teach merely the application of metallurgical principles and techniques already revealed in the prior art. It is well known, plaintiffs point out, that certain pairs of metals such as aluminum and nickel will, when heated together at suitable temperatures and proportions, react exothermically, that is, release a surplus quantity of heat to form an intermetallic compound such as nickel aluminide. This metallurgical effect, say plaintiffs, is disclosed in many earlier patents which render the claimed invention neither novel nor unobvious to one having ordinary skill in the art. Plaintiffs further contend that after rejecting five prior applications by the patentees, the examiner was prevailed upon in an ex parte interview to allow

5. Id., col. 5, lines 1-32.

6. Plaintiffs' opening statement, Tr. 20. "Tr." denotes pages of trial record.

the '515 patent to issue upon the fifth refiling and did so without being fully informed as to the prior art. The grant of the '515 patent led, in turn, to the issuance of the '248 patent.

To decide the questions of the lack of novelty and of obviousness or non-obviousness of the subject matter of the patents, "the scope and content of the prior art are to be determined; differences between the prior art and the claims at issue are to be ascertained; and the level of ordinary skill in the pertinent art resolved." Graham v. John Deere Co., 383 U.S. 1, 17-18, 148 USPQ 459, 466-467 (1966).

In this case, since plaintiffs claim as "prior art" certain "early work" of Dittrich, the surviving co-patentee,[7] and question the manner in which the patents were obtained, a chronological presentation hopefully will illumine discussion of the Graham issues which follow.

Scope and Content of Prior Art

Patentee's Early Work

Dittrich has been employed by Metco as an engineer since 1938. He was called by plaintiffs to testify concerning his early familiarity with the subject matter. After describing in general terms Metco's "experimental" interest in the developing field for metal spray powders in the period 1946-1955, Dittrich was particularly queried about work Metco had done for Climax Molybdenum Company during

7. In their Supplemental Notice of Reliance under 35 U.S.C. §282, dated October 16, 1973, as limited by a consent Order signed October 26, 1973, plaintiffs specified as prior art "the earlier work of the assignee Dittrich on nickel aluminum coatings to which he alluded at his deposition."

1951-1954 on so-called "layered coatings" of nickel-aluminum.

Climax at that time was seeking to prevent failures in molybdenum sheet metal used in jet engines which occurred because of its high oxidation rate at elevated temperatures. Dittrich participated in the experimental flame spraying work on panels of metal which were heat-tested in Climax's own laboratories. Through his own study of the available technical literature, he was aware it was "common knowledge" that nickel and aluminum were exothermic materials which would react in combination to form the intermetallic compound nickel aluminide, generating heat in the process, and that nickel aluminide had high oxidation resistance properties. In his work on the Climax problem he sprayed alternating layers of melted aluminum powder and melted nickel powder on metal panels without obtaining the desired exothermic reaction. Nor did he obtain such a reaction when he sprayed powder mixtures of nickel and aluminum.

After the "unsuccessful" work on the Climax problem, Dittrich continued intermittent spraying of layered coatings at Metco in attempts to obtain an exothermic reaction on the surface of a sprayed panel. He utilized not only nickel and aluminum but also aluminum and other metals. He continued this experimentation, he testified, with the thought that a reaction of combined metals on the surface of a substrate would provide both bonding and other qualities desired in the coating. Unable to accomplish this, he tried removing the layered coatings from the substrate and heating the sandwiched constructions with a torch. His findings on these sandwich experiments are summarized

in an internal Metco memorandum dated October 6, 1955, captioned "Combination (Exothermic) Reactions Upon Heating Layered Coatings of Various Metals." PX 16. There he reported:

> "Rapid local overheating of one corner of a Ni-Al sandwich will trigger a fairly violent exothermic reaction with the resulting alloying of the Ni and Al. The entire mass of the sheet will coalesce into pools of the alloy formed."

The reported results, he testified, led him to conclude then that a "composite" of nickel and aluminum in close physical contact, if reduced to the right particle size, appeared to be "a possibility" for use in flame spraying to obtain a sprayed coating with a good bond and the high oxidation resistance of nickel aluminide. Although acknowledging that both nickel and aluminum powders were then available, Metco made no effort to develop such a concept. Dittrich testified, in explanation, that Metco had no equipment for "agglomerating" metal particles and its homemade ball milling equipment was not adequate for the necessary grinding and sizing. Instead, Dittrich continued reviewing the literature, looking for a commercial means of obtaining such particles.[8]

Sometime in 1959 Dittrich found what he thought he was looking for in a publicized announcement of the Sherritt Gordon Mines Ltd. of Alberta, Canada. PX 52. The announcement stated that Sherritt Gordon would soon make available on a semi-commercial basis "metal and

8. Metco did not itself manufacture flame spray materials but had them made by others according to its own size and other specifications.

nonmetal powders coated with nickel, cobalt, copper and other metals" that "promise improved properties for powdered-metal and metal-ceramic parts." The announcement also mentioned particle size ranges which Dittrich conceded encompassed commonly known particle sizes of flame spray powder materials.

On February 24, 1959, shortly after seeing the Sherritt Gordon announcement, Dittrich wrote V. N. Mackiw of that company an "evasive" letter of inquiry requesting samples and other information about the newly announced metal-coated powders. In particular, he sought to know whether certain refractory oxide powders could be coated with nickel or cobalt, what size ranges could be coated and what the costs might be. Dittrich's letter concluded by stating "It is entirely possible that, with little development work, composite powders for coating could be developed which would be to our mutual benefit."[9]

As a result of his inquiry, Metco received information and samples and placed orders for a variety of coated powders to be produced by the Sherritt Gordon process upon which Mackiw had obtained a patent in September 1958.[10] See infra, p. 30. Dittrich experimented with these powders, which included aluminum coated with nickel, and concluded that the nickel-aluminum material had "many possibilities, but requires additional work." PX 33.

Dittrich reported his findings to Shepard, then manager of Metco's research and development department, in a memorandum dated December 18, 1959, entitled "Self

9. Dittrich was at that time time project engineer for Metco, which was then known as Metallizing Engineering Co., Inc. PX 53.

10. See PX 7, Prior Art Booklet, Mackiw.

Bonding Intermetallic Coatings for High Temperature Oxidation Resistance." Id. Therein he summarized the "well known" properties of nickel aluminide, its desirability as a coating fused to miscellaneous base materials exposed to corrosive environments, and the prior unsuccessful work with "simple mixtures of nickel and aluminum powder" on the Climax Molybdenum problem. The memorandum detailed his procuring of special nickel-aluminum powder particles he had Sherritt Gordon prepare and the self-bonding results obtained when sprayed as composite powder. With his report Dittrich transmitted a handwritten note dated December 21, 1959, in which he stated:

> "The following ideas and properties are, I believe, completely new and useful:
>
> "(1) Starting with a composite powder, using the heat of the flame to effect alloying.
>
> "(2) Using the heat generated by an exothermic combination reaction to superheat the particles in the spray-stream.
>
> "(3) A self bonding oxidation resistant material both for primary coatings to protect base materials from oxidation, and to use as an undercoat-oxidation resistant bonding coating for ceramic thermal barrier coatings." PX 33.

Dittrich's report and discussion with Shepard led to authorization for further developmental work. On July 1, 1960, Dittrich sent Sherritt Gordon 10½ pounds of "special aluminum powder" in five particle size ranges, requesting they be coated with nickel "to give a finished powder

which is the following composition by weight: aluminum 17.5% plus ½%/minus 1½%, nickel remainder." PX 50. He advised Sherritt Gordon "that this composition is the optimum for our purpose, and we would like your advice as to whether or not you can hold the above tolerance on the aluminum content of the finished powder." Id.

Dittrich conceded that the nickel-coated aluminum powder described in Example 1 of the '515 patent (and repeated in the '248 patent) was the material received from Sherritt Gordon in response to his letter and formed the basis for the patent application filed five months later.

The Patent Office Proceedings

The parent application filed November 22, 1960 was titled "Flame Spraying Synergistic[11] Composites." The specification pointed out that while metallic powders formed of several constituents were known in the flame spraying art, they were generally "a powder mixture" or at best "a particle aggregate." An object of the claimed invention was the spraying of heat-fusible material "in a novel form which allows the obtaining of superior results." The novel form was "a clad composite consisting of nuclei and at least one coating layer of a different material which will synergistically act with the nuclei in the process." The purpose was to increase "the thermal efficiency of the process, aid in the bonding of the coating and/or produce results and effects by this in situ generated heat which cannot be achieved by the externally supplied heat" of the

11. Webster defines "synergist" as "2. An agent that increases the effectiveness of another agent when combined with it." Third New International Dictionary (1971) at 2320.

flame spray gun. The specification noted that "Bonding to the base or substrate being coated may also be aided by the synergistic action of exothermic reaction, as for example, in the case of nickel-coated aluminum powder."

Flame spraying in accordance with the invention was to be effected "in the conventional manner." Production of the clad composite powder could be accomplished "in any known or desired manner" but "preferably by the known chemical plating processes." One was described as the process of plating by ammoniacal solution—the identical process disclosed in the earlier Mackiw patent hereinafter discussed. The drawing attached to the application contains a Fig. 1 cross-sectional diagram of a grain of the novel flame spray powder which is virtually identical with Fig. 1 in the Mackiw patent drawing, except for the substitution of "aluminum" for "metal nucleus" and of "nickel" for "metal coating."

The 1960 application presented 62 claims, some drawn to "improvements" in the flame spray process and others to a flame spray material, powder or wire. For example, Claim 51 specifically claims an

> "improvement to increase the bond which comprises spraying an intermediate layer of two components exothermically reacting with each other, forming an inter-metallic compound." PX 1.

Claim 24 describes

> "A flame spray powder in the form of individual, synergistically clad particles comprising a nucleus and at least one coating layer of a material differing from said nucleus and synergistically active with said nucleus in flame spraying." Id.

The Patent Office, perceiving the intermingling of different claims, allowed none and rejected none. Restriction was required on the ground that the claims were drawn to two separate and distinct inventions, (1) "a flame spray coating process," and (2) a powder and wire comprising "composite metal stock." PX 1.

The Patent Office action led to a succession of new application filings with gradually changing titles but all exhibiting the same amphibolous character as between product claims and process claims. PX 2-5. The examiner again required restriction of claims in the next application filed August 16, 1961, PX 2, citing the Gutzeit patent hereinafter discussed, infra p. 35. The patentees elected to prosecute claims drawn to "composite metal stock", reserving non-elected claims for a divisional application. The elected product claims were rejected as unpatentable in view of prior art not relied on here. Reconsideration was denied despite the patentees' argument that "[t]he concept of providing individual powder particles containing a nucleus and a coated layer * * * is entirely novel to the applicants and produces superior spraying results and superior coatings * * * bonded and placed more uniformly and securely."

On Metco's appeal, however, the Patent Office Board of Appeals reversed the examiner, ruling that the patent references he relied on "do not disclose or suggest the powder of the appealed claims." In consequence, U.S. Patent 3,254,970 (not involved here) was issued to the patentees on June 7, 1966, for a "flame spray clad powder composed of a refractory material and nickel or cobalt."[12]

12. Both the Gutzeit and Bradstreet patents, hereinafter discussed, were cited in the patent as references of record. Se infra pp. 32, 35.

The divisional application filed on October 26, 1962 included all claims except those allowed in U.S. Patent 3,254,970. PX 3. The examiner again rejected all remaining claims as unpatentable citing, among others, the Mackiw, Shwayder, Bleakley, Hensel and Montgomery patents relied on by plaintiffs here. See infra pp. 28-33. The examiner viewed those references as collectively teaching various techniques in flame spraying and the employment of particulate material, from which it would be obvious that percentages of material are a mere matter of choice. The application was marked "Abandoned." PX 3.

A further application was filed on February 10, 1964, as a continuation-in-part of the prior applications. PX 4. This application was also subjected to a restriction requirement because claims were drawn to four separate and distinct inventions, i.e., a process of flame spraying, a composite metal stock particle, a composite metal wire, and a process of applying a coating to a particular powder.

The patentees elected to proceed with a group of claims drawn to the process of producing a coated flame spray powder. The described process, which is pertinent to the claims in suit, included a method more simple than chemical plating for cladding a nickel nucleus with finely-divided aluminum particles. It consisted of dispersing aluminum powder in a "binder" such as phenolic varnish and admixing it with a nickel powder to form the composites, which are then dried to form a free-flowing powder.

The examiner rejected all the process claims as unpatentable over Hensel and Mackiw, among other references, pointing out that the process of coating a metal

powder with an adhesive and coating the substrate with another metal were techniques well known in the art. The patentees, citing 35 U.S.C. §103, filed a response arguing that the subject matter "as a whole" related to a process for producing a specific material, i.e., a flame spray powder which is self-bonding, and that "the crux of the invention resides in this choice of metals" in order to achieve the specific self-bonding result not otherwise attainable. PX 4, p. 78.

On December 23, 1966, the Board of Appeals affirmed the examiner in all respects, viewing the claims as simply "a method for coating metal powder (e.g., nickel) with a different metal powder (e.g., aluminum.)" The Grala patent, hereinafter discussed, was added as a reference "to show that aluminum and nickel are known to form a compound Ni Al with high exothermic heat development" and that it is clear from Mackiw "that composite binary coated powders are well known * * * and we find a teaching therein that aluminum powder can be coated with nickel (column 2, lines 16 and 34)." PX 4.

Prior to the Board of Appeals rejection of the 1964 process application, the patentees on March 25, 1965, filed the product application which resulted in the issuance of the '515 patent. PX 5. That application, filed as a continuation-in-part of the 1964 application, was identical with the latter in its specification of the claimed invention, including the references to "self-bonding." The restricted claims, however, relating to the flame spray material itself (product) were renumbered.

Renumbered claim 1 reads:

> "A flame spray material comprising a composite in a form suitable for flame spraying, formed of at least two metal components which exothermically react with each other when melted, forming an intermetallic compound."

The foregoing is the exact statement of claim 1 of the '515 patent except for the later addition of the following language appearing in the patent (PX 11, col. 15, lines 63-65):

> "and characterized by the ability of generating heat during flame spraying which aids in bonding to the surface being sprayed."

The genesis of the foregoing language becomes evident from the further proceedings.

After some preliminary contention over the examiner's requirement for further distinction as between process and metal stock material again intermingled in the claims as drawn, the examiner on April 15, 1966 rejected the claims now embraced in the '515 patent "for failing to particularly point out and claim the invention as required in 35 U.S.C. 112" and also as unpatentable under 35 U.S.C. §103[13]

13. The examiner held the claims

"unpatentable over Bayer in view of Schrewelius, Herz, Grala et al., and Mackiw et al. The basic reference discloses exorthermically reacting metal powders. Grala et al. teaches that nickel and aluminum are exothermically reacting elements. Schrewelius teaches that it is old to add boron to flame-spray powders. Herz teaches that it is old and well known to have powder metals for flame spraying in hydride form. Mackiw et al. shows that it is old to form composites of metal powders by having a metal coating covering a metal nucleus. No invention is seen in substituting nickel and aluminum or other elements known to be exothermically reactive in the composition of the basic reference. Or in adding boron a well known fluxing element or in having the metals in the form of hydrides or in employing the coated composite because all these are taught by the secondary references to be old and well known in the art and the applicants have produced no new and unobvious results." PX 5, pp. 66-67.

Metco responded to the examiner's action by making certain amendments which became the present '515 patent claims, contending that the "invention as set forth in the instant application is believed to be directed to a major breakthrough and pioneering development in the flame spray field." PX 5 at p. 71. Stressing that under 35 U.S.C. §103 the invention as a whole must be considered, including unique and unexpected properties possessed by a material, and disclaiming any intent to obtain a patent on well-known metallurgical phenomena. Metco defined the canned invention as follows:

> "The applicants' * * * invention is limited to the concept of combining the metals which are known to react in this manner into the flame spray composite which produces the completely novel flame spray material. There is, of course, nothing in the prior art which would teach or indicate that merely because components would react in this manner that they would be useful as flame spray material or that the same should be combined in a specific form in order to make a successful self-bonding flame spray material." PX 5 at p. 76.

The examiner, stating he was unable to see "what *unique* and *unexpected* properties" the material possessed "that would make it unobvious from the art cited", adhered to his ruling.

On November 9, 1966, Metco responded to the examiner's action by making the addendum to claim 1 quoted above as indicative of "the unexpected properties which the material possesses" and which must be considered under §103. On that same date an ex parte discussion occurred

between Metro's patent counsel and the examiner—which plaintiffs criticize—and shortly thereafter the examiner allowed the '515 patent on the flame spray powder claims.

On May 26, 1966, a further application was filed as a division of the March 1965 application ('515 patent) covering the flame spraying process claims as to which restriction had been required. PX 6. That application also survived prior rejections by the examiner and led to the issuance of the '248 patent. The first rejection came on December 11, 1967, the examiner relying on Herz, Shwayder, Bleakley, Mackiw, Bradstreet and Grala, hereinafter mentioned, in addition to other prior art. These references in the examiner's view showed it was old and obvious to apply flame spray coatings of exothermically reacting materials, to use coated component powders in the process, and to utilize a binder to form the feed materials. PX 6, pp. 65-66. Metco obtained reconsideration, contending that none of the references disclosed the flame spraying of a composite containing components which exothermically reacted to form an intermetallic compound, or taught a process capable of achieving the novel self-bonding result claimed.

When the examiner adhered to his rejection, Metco's patent counsel again obtained an ex parte interview—also criticized by plaintiffs—and submitted an affidavit by Dittrich, sworn to June 10, 1968, stating that tests in which a mere combination of nickel powder and aluminum powder were flame sprayed onto a substrate, did not result in an adherent coating, whereas those metals did so when prepared in accordance with the process claims of the applica-

tion and had the tensile bond strength stated in the affidavit. Following that conference, claim 1 was amended to state that the heat-fusible components "are distinct and unalloyed with respect to each other and * * * are present in the form and in proportion such that they react exothermically with each other." Metco emphasized "that the nature of the physical association of the two components used in this process is critical." Thereafter the process claims were allowed and the '248 patent issued.

Prior Art References

The prior art plaintiffs relied on at trial is listed in the margin.[14] Of the ten prior patents designated, only one, Haglund No. 2,943,951, was not referenced by the Patent Office in the prosecution of the patents in suit. The Bleakley, Mackiw, Herz, Grala and Shwayder patents are specifically cited in the '248 patent, and Mackiw, Herz and Grala are also cited in the '515 patent. The Hensel, Mont-

14.

Bleakley	2,231,247	Feb. 11, 1941
Herz	2,884,688	May 5, 1959
Bradstreet	2,904,449	Sept. 15, 1959
Haglund	2,943,951	July 5, 1960
Montgomery	2,775,531	Dec. 25, 1956
Gutzeit	2,908,589	Oct. 13, 1959
Mackiw	2,853,403	Sept. 23, 1958
Grala	2,910,356	Oct. 27, 1959
Scwayder	3,049,435	Aug. 14, 1962
Hensel	2,370,242	Feb. 27, 1945

Journal of the Electrochemical Society, Feb. 1957, pp. 104-110, "Structure of Chemically Deposited Nickel", by Gutzeit, et al.

The alleged "earlier work" of the patentee, Dittrich, on nickel-aluminum coatings referred to in Supplemental Notice of Reliance, dated October 16, 1973.

gomery, Bleakley, Bradstreet and Gutzeit[15] patents were specifically cited and discussed by the Patent Office in reviewing the several applications for the patents in suit.

The '515 and '248 patents are so closely interrelated as not to warrant separate discussion of the prior art as between product and process.

The earliest reference, Bleakley (1941), is titled "Method of Forming Composite Metal Structures." The examiner twice cited Bleakley, among others, in rejecting Metco's claims (PX 2, 6) on the ground it was obvious to spray two or more metals in combination. Bleakley teaches the feeding of two or more metals or other materials of different melting points separately but simultaneously into a closed melting chamber under pressure and spraying them in their mixed molten state onto the surface to be coated. The metals were fed into the chambers in "strands" of rod or wire. To obtain "a good bond" it was necessary to first prepare the surface either by using a "thermit" type flux or by heating it to bonding temperature during the spraying operation. No claim was made that the resultant coating was self-bonding.

Hensel (1945), titled "Refractory Metal Composition", discloses an improvement for "powder metal bodies" formed according to the procedures of powder metallurgy. Plaintiffs rely on Hensel to show only that the process

15. Plaintiffs suggest that the Gutzeit patent was cited only to support a requirement for restriction and not considered for technical content. See PX 2, p. 67. This overlooks the fact that both Gutzeit and Bradstreet appear as "References Cited By Examiner" as of record in the allowance of U.S. Patent 3,254,970 to Dittrich and Shepard. See PX 2 at p. 130. Plaintiffs' argument that the patentees made a "surreptitious attempt" to remove Gutzeit from the attention of the Patent Office (Post-Trial Brief at 19) is therefore rejected.

recommended in the patents in suit for making clad or "coated" particles by coating the powder granules of the component with an adhesive (binder) and then dusting the adhesive-coated particles with another metal in powdered form was long known in the art. Even Hensel does not claim the invention of this adhesive coating technique nor does his patent relate to flame spraying.

Montgomery (1956), titled "Method of Coating a Metal Surface", relates to the formation and spraying of what are known as "cermet" flame spray materials composed of "a bonded mixture" of particles of metal and particles of a ceramic material such as a metal oxide. The cermet particles may be flame sprayed but it is done by a "powder weld" process which involves a subsequent fusion or welding step to make the coating material stick to the surface. The patent recommends that the surface "be sand-blasted before applying the coating," There is nothing in Montgomery which discloses or suggests a self-bonding material.

Mackiw (1958), heavily relied on by plaintiffs, is titled "Method of Producing Composite Metal Powders" and discloses a chemical plating process for producing "a composite metal powder comprised of at least two different metals" having different chemical and/or physical properties. As already noted, the identical drawings of the '515 and '248 patents contain a Fig. 1 cross-section of a clad particle composite of aluminum core with nickel coating that is virtually identical with a cross-section drawing of a composite nucleus and coating of two undesignated metals in Fig. 1 of Mackiw. Also, both the '515 and '248 patents describe as one method of making the "clad powders" the

use of the same chemical plating process described in Mackiw.

Mackiw, however, discloses no relationship between the composite metal powders there described and the art of flame spraying. Mackiw's object, like that of Hensel, was to develop an improved process for producing composite metal powders for use particularly in powder metallurgy. While plaintiffs insist that "powder metallurgy" includes flame spraying, it is plain from Mackiw and Hensel that the term connotes the art of compacting or pressing metal powder into shapes for alloying treatment in the manufacture of metal parts which do not lend themselves to fabrication by conventional melting and casting methods.[16] Nor is there any suggestion in Mackiw of a *combination* of nickel-aluminum. Both metals are merely listed in a larger group having similar properties which may be dispersed in a chemical solution in order to coalesce with metals of another group having disparate properties.

Focusing on another element of the claimed invention, plaintiffs point to the Herz and Grala patents (both 1959) as showing it was well known that nickel and aluminum "in the proper proportions and in composite form reacted together in an exothermic reaction to form the intermetallic compound, nickel aluminide."[17] Herz, titled "Sintered Ni-Al-Zr Compositions", is another patent in the field of powder metallurgy rather than flame spraying or flame spray

16. The Sherritt Gordon announcement, supra p. 14, also indicates that the Mackiw powders were primarily directed to mettalurgical procedures quite different from flame spraying, such as roll-compacting (direct production of metal strip from powder), and standard pressing and sintering techniques. PX 52.

17. Pl. Post-Trial Brief at 21.

materials. Its disclosure is directed entirely to the preparation of a nickel-aluminum alloy which would not deteriorate when formed into shapes but could retain high rupture strength for prolonged periods at high temperatures in use. Herz found that the addition of zirconium, and heating the nickel-aluminum-zirconium powder mixture until an "exothermic reaction" began, produced a nickel aluminide plus zirconium as a homogenous conglomerate. This material was then crushed again into powder in order to compact or cold press various shapes as desired and to give them the requisite 100% density by sintering at high temperatures.

Grala, on the other hand, while also concerned with nickel-aluminum intermetallic composition prepared by the method of powder metallurgy, sought to overcome or control the exothermic heat developed by the intermetallic reaction which had been found to weaken the resulting alloy. Grala's solution was to design a special induction furnace unit, as illustrated in the patent, and to prepare the nicked and aluminum charge not in powder or grain form but as small flat chips and fragments with the aluminum placed on top of the nickel in a crucible.

Bradstreet (1959), titled "Method and Compositions for Flame Spraying", relates to methods of overcoming the problem of "glassy coatings" when surfaces were flame sprayed with ceramic materials such as refractory oxides. Due to the brittle nature of glass, such coatings frequently failed by cracking or chipping because of the unequal thermal expansion of the underlying substrate. Bradstreet found that this "glassy" effect could be avoided by retaining the crystalline structure of the ceramic starting materials during the flame spraying process. Bradstreet teaches that one of several ways to accomplish this is to inject finely-divided aluminum powder into the flame along with the ceramic material. As the aluminum oxidizes, i.e., burns, it raises the temperature providing additional heat to allow high melting ceramic material to reach its sintering temperature, the critical factor in the retention of the desired crystalline structure of the refractory coating. Bradstreet claims that applying any of the several methods he describes will result in the "deposit of the sintered particles as an adherent coating on said surfaces."[18] However, although Examples I and II of the patent refer to coatings that were "tightly adherent to the surface", no claim of self-bonding was made. Each example shows that the steel surface was "sand blasted prior to application", and in Example I also "treated with a solution of phosphoric acid." And Bradstreet himself recommended that "to improve * * * the bond * * * it is desirable to roughen the surface prior to application of the coating.[19]

Shwayder (1962), titled "Process for Applying Tungsten Carbide Particles to a Workpiece Surface", was directed to overcoming the substantial loss of expensive tungsten carbide through vaporization, oxidation or dissolution during the process of welding it to metal surfaces to harden them. Shwayder's solution was to coat the ground tungsten carbide particles with nickel or nickel-nickel phosphide as a "sacrificial material which evaporates, oxidizes and also dissolves in ferrous material", saving the tungsten

18. PX 7, Bradstreet, cols. 8-9.

19. PX 7, Bradstreet, col. 6, lines 1-4.

carbide from a similar fate and avoiding its loss during welding.

As taught in Shwayder, the nickel coating of the tungsten carbide particles could be accomplished either by an electrolytic bath or a chemical process described in another patent. One of several methods to apply the coated particles was by flame spraying them onto the workpiece "and simultaneously flame heating both workpiece and particles." No claim was made that the coating was self-bonding.

Haglund (1960), not cited by the examiner, is offered by plaintiffs as a further prior disclosure of mixing aluminum with flame spray materials to generate additional heat by means of an exothermic reaction. The parties agree that Haglund, titled "Flame Spraying Method and Composition", relates to the flame spraying of molybdenum disilicide. Particles of that composition are normally coated with a silicon dioxide film which prevents them from sticking together to form a "coherent" coating upon a surface when they are flame sprayed. Haglund solves this problem by the addition of metallic aluminum which exothermically reacts with the silicon dioxide during the flame spraying, thereby enhancing "the sintering together of the surface coating on the object treated."[20] The heat of the exothermic reaction overcomes the silicon dioxide coating and enables the particles of molybdenum disilicide to stick *together*; there is no indication it has anything to do with their sticking to the surface being sprayed.

Gutzeit (1959), on which plaintiffs most heavily rely and contend was overlooked by the examiner, but see n. 15, supra, was considered by their expert, Dr. Nicholas J.

20. PX 7, Haglund, col. 1, lines 55-60.

Grant, to be the most pertinent prior art reference. Entitled "Method of Flame Spraying an Alloy and the Resulting Article", Gutzeit and his related article written in 1956, n. 14, supra, according to plaintiffs, clearly anticipate the Metco patents in disclosing a flame spray material "in composite form", namely nickel and phosphorus, which "reacts exothermically" when flame sprayed "to form the intermetallic compound nickel phosphide." They further claim that the "heat developed in this reaction" improves the adherence or bonding of the sprayed coating to the surface.[21]

There is no dispute that the Gutzeit nickel-phosphorus material is the waste metallic reaction precipitate of a chemical plating bath utilized in another industrial process,[22] although phosphorus itself is not a metal. The Gutzeit patent was directed to a method of reclaiming valuable nickel and phosphide in the spent bath. The salvaged precipitation material is dried and ground into an "alloy" powder which may be flame sprayed in a conventional manner to form a "coherent" and "adhering" nickel phosphide coating on a surface. Dr. Grant acknowledged that the Gutzeit material was unique and specialized and could only be obtained from the spent plating bath source. Nonetheless, he characterized it as a "composite" of nickel and phosphorus which formed an intermetallic compound when

21. Pl. Post-Trial Brief at 18-19.

22. Known as the Kanigen process, in which the nickel coating of interiors of large tanks or other vessels is accomplished by a chemical reduction method. The coating bath is regenerated from time to time but eventually must be discarded due to a buildup of unwanted nickel phosphide. Gutzeit's object was to salvage the nickel and try to put it to some use.

subjected to heat, as indicated in Gutzeit's 1956 article, and thus anticipated the claimed invention of the Metco patents.

Plaintiffs contend that the prior art "reveals every facet of the patented invention" and therefore nothing "new" has been contributed to the existing fund of knowledge as required by 35 U.S.C. §101.[23] Without doubt, as they point out, the prior patents exhibit such separate features of the invention as coated particles (Mackiw, Hensel), the simultaneous flame spraying of different melting point metals (Bleakley), the use of aluminum powder to start an exothermic reaction during flame spraying for the purpose of generating heat (Bradstreet, Haglund), and the flame spraying of a combination powder material to form an intermetallic compound coating (Gutzeit). But to say that the presence of these features deprives the Metco powders of all patentable novelty "falls slightly short of the mark because the fact that each of its elements may be anticipated by prior art does not preclude patentability of a novel and nonobvious *combination.* * * * The inquiry to be made is whether the combination produces a nonobvious 'synergistic result,' in which the 'whole in some way exceeds the sum of its parts' " [emphasis in original; citations omitted]. Koppers Company, Inc. v. S & S Corrugated Paper Machinery Co., Inc., 517 F.2d 1182, 1188, 185 USPQ 705, 710-11 (2 Cir. 1975).

The question of novelty under §§101-102 is, of course, distinct from that of obviousness under §103, a defense also

23. 35 U.S.C. §101 provides in part:

"Whoever invents or discovers any new and useful process * * * or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor. * * *"

strenuously advanced by plaintiffs. Burgess Cellulose Company v. Wood Flong Corporation, 431 F.2d 505, 508, 166 USPQ 417, 419-420 (2 Cir. 1970). A resolution of those questions necessarily requires a closer comparison of the prior art and the claimed invention, and to that we now turn.

Differences Between Prior Art and Claims in Suit

Ascertaining the differences between the prior art and the claims at issue requires a precise understanding of the inventive idea the claims are said to embody. The patentees do not claim discovery of the principles of exothermic reaction or intermetallic compound formation as between certain metals. Their patent specification acknowledges that "[a]n extremely large number of metal components are known which can be melted together in an exothermic reaction, forming an intermetallic compound with the generation of heat." PX 11, col. 3, lines 58-61. Admittedly "[a]ny of these component pairs may be utilized in accordance with the invention" provided they are suitable for flame spraying as taught in the patent. Id. And, as Dittrich acknowledged in his research memorandum of December 18, 1959, "[t]he high temperature strength and oxidation resistance of the intermetallic compounds, nickel aluminide in particular, are well known." PX 33.

Nor do the patentees claim invention of the methods or processes by which the component metals, for example, nickel and aluminum, may be united to form clad "composite" powder granules. Mackiw (1958) unquestionably discloses one "mode of *forming* the clad powders" de-

scribed in the '515 patent. PX 11, col. 4, lines 63-68, emphasis supplied. Indeed, it was news of Mackiw's commercially feasible method of producing coated powder particles, Dittrich testified, that spurred him to resume experimental work on the flame spray powders described in the '515 patent. PX 52, 53. The other "preferred and greatly simplified mode of forming the clad powders," the adhesive binder technique, PX 11, col. 5, lines 1-17, while apparently considered novel by Dittrich, was long ago mentioned by Hensel (1945) as the examiner repeatedly pointed out during the prosecution.

What then is the basic idea which can fairly be seen to be "new and useful," §101, and not found in the prior art? Dittrich's own pithy statement, quoted from PX 33 supra p. 16, is difficult to improve upon. In terms of the claims in issue, he taught the flame spray art how a highly oxidation-resistant nickel aluminide coating could be made to *self-bond* firmly to a clean smooth substrate by the use of conventional flame spray equipment and procedures. To achieve that result, however, the starting material must be capable of generating an exothermic reaction releasing sufficient heat to superheat the particles in the spraystream so that they would bond to the surface. The only way to ensure and control such a reaction was to prepare the nickel-aluminum powedr or wire in the composite form described in the patents and illustrated in the patent drawing.

Plaintiffs challenge the novelty of such claims, asserting that Dittrich simply obtained a patent on Mackiw's ready-made material or at best found a "new use" for an old

material which could not be patentable.[24] The Mackiw claims, however, were of very limited nature, being directed solely to a *method* for chemically plating or coating particles of one metal with another so as to produce "a composite metal powder." PX 7, Mackiw. To the extent that any use of such powders was suggested, it was to form "compacts, particularly in powder metallurgy * * * in the manufacture of special metal parts * * * [and] also in the powder metal industry." Id. and PX 52. There was no mention of flame spraying, nor of the selection of any particular metals to accomplish a given result, but merely a large enumeration of metals in groups, including nickel and aluminum, which are amenable to the Mackiw process.

Furthermore, plaintiffs' own evidence shows that the nickel-aluminum particle composites which became the patented flame spray powders in suit were the product of Dittrich's specifications, not Mackiw's. Metco, as already noted, was primarily a manufacturer of metallizing and flame spraying equipment and had been long engaged in technical research and development in that field. DX IA. While it sold powder and wire materials to users of such equipment, those materials were made by others according to Metco technical specifications, supra n. 8. The same procedure was followed in 1959-1960 when Dittrich pro-

24. For the latter proposition, plaintiffs cite a comment of Judge Learned Hand in Old Town Ribbon & Carbon Co. v. Columbia R. C. Mfg. Co., 159 F.2d 379, 72 USPQ 57, (2 Cir. 1947), a case decided prior to the 1952 Patent Act which modified the old rule by allowing patentability for a "new use of a known process, composition of matter or material." Rohm & Haas Co. v. Roberts Chemical, Inc., 245 F.2d 693, 699, 113 USPQ 423, 427 (4 Cir. 1957). See also Ansul Company v. Uniroyal, Inc., 448 F.2d 872, 169 USPQ 759 (2 Cir. 1971); Application of Waldbaum, 457 F.2d 997, 1002-3, 173 USPQ 430, 433-434 (C.C.P.A. 1972).

cured specially ordered nickel-aluminum coated sample powders from Sherritt Gordon, Mackiw's employer. PX 53, 33 and 50. The contemplated use and function of these special powders was also Dittrich's idea, not Mackiw's. An inventor need not perfect the embodiment of his idea with his own hands; he "may use the services, ideas and aid of others. * * *" Hobbs v. United States Atomic Energy Commission, 451 F.2d 849, 864, 171 USPQ 713 (5 Cir. 1971).

Mackiw's invention of a *method* for producing composite metal particles cannot be found to have anticipated the solution of the self-bonding problem in flame spraying to which the claims here were directed. Nor can Gutzeit's process for reclaiming and utilizing unique prereacted industrial waste be seriously viewed as such an answer. The evidence is compelling that it was Dittrich, admittedly with the aid of Mackiw's process, who taught how commercially available metal powders could be adapted for use in the ordinary flame spraying process to obtain the sought-after self-bonding coating desired by the trade.

On the evidence and compared against the prior art, the nickel-aluminum flame spray materials disclosed in the claims at issue were clearly a "new and useful * * * composition of matter" in their distinctive arrangement, function and end result, and therefore patentable under 35 U.S.C. §§101, 102.

Novelty and unquestioned utility, however, do not guarantee patentability. "A device may be new and useful and yet still not be patentable if an examination of the prior art and the ordinary skill of the artisan reveals that the new and useful innovation is obvious." Burgess Cellulose Company v. Wood Flong Corporation, supra, at 508, 166 USPQ at 419-420.

The Question of Obviousness

Plaintiffs assert obviousness under 35 U.S.C. §103 as their strongest challenge to the validity of Metco's patent claims, based on a somewhat different definition of the applicable field of prior art and the level of ordinary skill of those engaged in the art. Their overall view of the prior art is virtually identical with the contention of a plaintiff accused infringer quoted in Koppers Company, Inc. v. S & S Corrugated Paper Machinery Corporation, 517 F.2d 1182, 1187-88, 185 USPQ at 710 (2 Cir. 1975):

> **"The only difference between the subject matter of [claims in suit] and the prior art is that four well-known elements have been combined in a single device wherein the elements function in the same manner as was known in the prior art and produce the same expected results."**

Here, of course, the four key elements are (1) nickel-aluminum "composite" powder, (2) flame spray process, (3) exothermic reaction generating additional heat, and (4) which aids in self-bonding the resultant coating to the substrate. But unlike Koppers, supra, there is a serious dispute as to whether elements (1) and (4) appear in some form in applicable prior art which would render them obvious to one of ordinary skill in the art.

"In making the determination of 'obviousness'," the Supreme Court has only recently reminded us, "it is important to remember that the criterion is measured not in terms of what would be obvious to a layman but rather what would be obvious to 'one reasonably skilled in [the applicable] art.' Graham, supra, 383 U.S. at 37, 148 USPQ at 474." Dann v. Johnson, S.Ct. , 44 LW 4463 at 4466, 189 USPQ 257 (March 30, 1976).

Since the parties here disagree as to what is the applicable art, that question must first be resolved. Metco contends it is the art of flame spraying previously described, supra p. 5. Plaintiffs contend that flame spraying is but one of the techniques employed in the broader and presumably more learned field of powder metallurgy. Portions of treaties in evidence tend to support plaintiffs' view. PX 72, 73. But one of them also shows that powder metallurgy as an art is a "somewhat narrow field * * * concerned with molding and sintering of powders to produce finished parts" and thus quite different from the art of flame spraying, which is concerned with the coating of metal surfaces. Some confirmation of this distinction appears from an earlier patent application of one of plaintiff Eutectic's own engineers, which referred to "The art of flame spraying." DX CS. The court finds that the art of flame spraying is of such technical complexity and industrial importance, and so sufficiently distinct from the art of powder metallurgy, as to be considered the applicable art for purposes of this case.

Whatever may be the relationship or distinction between powder metallurgy and flame spraying, there is no doubt that the level of ordinary skill applicable here is not that of the shop artisan but of the professionally trained technologist. As is evident from both the prior art and the technical qualifications of party employees who testified, the average skilled worker engaged in the engineering research and development of either field would have held degrees in metallurgy or physical chemistry and perhaps even advanced degrees up to the doctorate. For example, Dr. Herbert S. Ingham, Jr., manager of Metco's research and development department since he came there in 1960,

holds B.S., M.S. and Ph.D. degrees in physics. Eutectic's vice-president in overall charge of research and development, Joseph F. Quaas, holds degrees in chemical engineering and chemistry and prior to coming to Eutectic in 1950 had been employed as a metallurgist and development engineer in the steel industry. While Dittrich was not the holder of academic degrees, there is no question that his early technical training in the engineering field was substantially broadened by long experience in research and development at Metco, as is evident from the paper he presented to the American Ceramic Society in 1963. PX 40.

Would it have been obvious to those so skilled that the formation and flame spraying of nickel-aluminum powders as taught in the patents in suit would produce a self-bonding coating on a metal substrate that had not been heated or otherwise treated to receive it? Dr. Grant, plaintiffs' expert, agreed that by "self-bonding" was meant a coating which would weld or alloy to the substrate in an as-sprayed condition and that a tenacious bond was one within the range of 2,000 to 4,000 psi. There is no question that the Metco powders fulfilled these requirements. He conceded also that prior to the introduction of the Metco nickel-aluminum powders, the only known self-bonding flame spray material was molybdenum wire, of whose limitations he was aware. And he acknowledged that the Metco powders and wire were the first to be accepted as self-bonding materials which had a higher bond strength on the average than molybdenum and that they opened up new areas of use in the glass molds and aircraft industries.

Dr. Grant nonetheless was of the opinion that the composition, reaction and end result of the Metco powders was

entirely "predictable" from the prior art and would have been obvious to the technically trained worker in the field of powder metallurgy. He particularly stressed the Gutzeit process patent and related article as prior teaching that a composite of powdered nickel and another element (phosphorus) would react exothermically when flame sprayed to aid in bonding the resultant coating to the substrate. And in Mackiw, he saw the very same coated composite particles that are taught in the patents in suit. In his view, it would have been a simple matter to substitute aluminum for the phosphorus to achieve a nickel aluminide coating instead of a nickel phosphide coating. He pointed out that both Haglund and Bradstreet disclosed the use of fine aluminum particles to produce an exothermic reaction which would generate additional heat during flame spraying to aid in bonding the sprayed material. He found nothing unobvious or unexpected about the self-bonding of a coating to a substrate. The fusing or alloying of one metal with another, he testified, was simply the known metallurgical result of the application of enough heat to bring it about.

In view of Dr. Grant's undoubtedly eminent teaching and other qualifications in the field of metallurgy,[25] Metco

25. Dr. Nicholas J. Grant has been a professor of metallurgy and material science at the Massachusetts Institute of Technology since 1945, and since 1968 has been Director of its Center for Material Science and Engineering. He holds the degrees of B.S. in metallurgy from Carnegie Technical Institute and of Sc.D. in metallurgy from M.I.T. Prior to his teaching career he was a metallurgist for Bethlehem Steel Company and subsequently held executive positions in a research laboratory and an industrial company. Commencing in 1947 he has been retained as a consultant by some 24 leading in-

(footnote continued on next page)

challenged the validity of his conclusions as to obviousness by pointing out that he was admittedly a scientist, not involved with flame spraying except as an observer in connection with some of his consulting work. Dr. Grant acknowledged he has authored no writings on the subject nor has he ever had occasion to flame spray any of the materials about which he had testified. He also conceded he had no knowledge that any of the materials referred to in the prior art patents had ever been used commercially or were in fact self-bondings as he himself had defined the term.[26]

As already noted, none of the prior art patents relating to flame spraying claimed to disclose a self-bonding mate-

dustrial corporations, such as Corning Glass Works, Reynolds Metals Company, Kennecott Copper Company, Monsanto, Jones & Laughlin Steel Corporation, Boeing Aircraft Company, Raytheon and others, and also for the Oak Ridge National Laboratory and the Aberdeen Proving Grounds. He is also a member of some 14 government advisory committees concerned with technical matters. He holds 25 United States patents and numerous foreign patents, many relating to the field of powder metallurgy. He has authored over 270 publications in U.S. and foreign journals, numerous book chapters, and is co-author of "Behavior of Materials at Elevated Temperatures," M.I.T. Press, 1965. A list of professional societies of which he is a member and awards he has received are found in a more complete statement of his qualifications in evidence as PX 8.

26. To establish that such prior art materials were not in fact self-bonding, Metco noticed and conducted a series of inter partes tests (Tr. 1640-41) in which the materials were fabricated and sprayed on test panels. Plaintiffs chose not to participate in the tests but conducted cross-examination of Metco's Dr. Herbert S. Ingham, Jr., who described the tests made and offered in evidence the respective test panels. Tr. 1640, et seq. DX KA, KB, KE-1, KE-4, KE-3, KE-8, KE-6, KE-7. In view of the controversy which arose over whether the spraying was conducted with due regard to parameters, the court did not take them into consideration in reaching its decision with respect to the validity of the patents in suit.

rial in the sense of one requiring no prior preparation of the surface to be coated.[27] Dr. Grant found it necessary to read such terms as "coherent coating," "adhesion," "chemical bond," and "wetting"[28] appearing in those patents as equivalents of "self-bonding." Bleakley (1941), however, required that the aluminum powder or other "thermit" mixtures used as a flux or heating agent to bring the substrate to "bonding temperature" be applied in dry or paste form to the surface and separately ignited by the flame issuing from the nozzle of the flame spray equipment. Montgomery (1956), while referring to "an alloying reaction between the metal coating and the metal base," strongly recommended that the "substrate be sandblasted before applying the coating." Bradstreet (1959) similarly recommended that the substrate surface be "sandblasted prior to application of the flame spray coating." Gutzeit (1959) also recommended "preliminary grit blasting of the surface." Haglund (1960), which was not before the patent examiner, was concerned only with the penetration or dissipation of a surface film of silicon dioxide interfering with the spraying of molybdenum dicilicide and is without relevance here. Shwayder (1962) required heating of the "workpiece" (substrate) in order to accomplish the desired hard surfacing by spraying tungsten carbide.

27. Co-patentee Shepard's prior molybdenum wire patent could not be relied upon as prior art, although it was a self-bonding material, because the self-bonding effect was entirely due to the unique characteristics of molybdenum, which, in any event, was not a metal but a refractory-type material.

28. "Wetting" is a term of art denoting the ability of melted material to penetrate a metallic surface so as to fuse or alloy with it.

Faced with the foregoing prior art, it is difficult to believe that one reasonably skilled in the art would have found it obvious to combine their teaching into the concept or reality of a *self-bonding* flame spray material as taught in the claims in suit. On the contrary, "[r]ather than serving to point the way to innovation * * * [such] teachings would tend to discourage one skilled in the art from investigating the methods ultimately used" by Dittrich to make a combination of nickel-aluminum powder self-bond to an unprepared surface. See Shaw v. E.B. & A.C. Whiting Company, 417 F.2d 1097, 1104, 163 USPQ 580, 585-587 (2 Cir. 1969).

With greatest respect for the opinions of Dr. Grant as a scientist and teacher, the court is unable to find that a self-bonding coating can be seen in the prior art as an obvious consequence of the exothermic reaction of nickel and aluminum. Indeed, Dittrich's own early work, supra p. 14, et seq., on which plaintiffs rely as prior art, demonstrated that in practice exothermic reactions between nickel and aluminum occur only under certain conditions, see PX 16, and that powder *mixtures* of those metals do not form a self-bonded coating when flame sprayed. PX 33, PX 6, pp. 89-90. Nor was it possible to form bonded nickel aluminide coatings on molybdenum steel sheet by spraying layered coatings of nickel and aluminum and applying subsequent heat treatment. PX 16, 33. These early failures cannot be attributed to lack of ordinary skill, since the work was undertaken with technical laboratory personnel of Climax Molybdenum Corporation, a leading company in the field of metals.

As Metco consistently stressed throughout the patent prosecution, the selection of the component metals and the nature of their physical association in composite form was the critical factor in producing a superior and unexpected self-bonding flame spray material. Dittrich was without doubt the first to recognize, develop and adapt the concept of coated or clad powder particles for use in flame spraying to achieve a self-bonded surface coating without prior preparation of the substrate. Contrary to plaintiffs' assertions, the result was both "synergistic" and unexpected. It was synergistic in two respects: (1) whereas nicked and aluminum powders sprayed separately or combined as a mixture did not bond, they unfailingly did so when sprayed in the "composite" form taught by the patents; and (2) when so sprayed they formed a firmly bonded coating having greater oxidation resistance than the component metals possessed cumulatively.

That the result was unexpected is apparent from the unusual behavior of the composite particles during spraying. As Dittrich noted in his paper for the American Ceramic Society, PX 40, sprayed metal powder particles normally reached their peak temperature in the hottest part of the spray gun flame and then decreased in temperature as they traveled away from the nozzle. The patented composite powders, in contrast, did just the opposite by increasing their temperature as they traveled toward the substrate and away from the hottest zone of the combustion flame. The physical association of the component metals in "composite" form would therefore appear to be the critical factor in controlling their exothermic reaction so as to generate the necessary additional heat at the right moment to bond the coating to the surface.

That Dittrich thought Mackiw's process might be useful in the commercial preparation of such self-bonding flame spray powders or that they now appear to be simple compositions of well known elements did not render them obvious. The court may not indulge in hindsight to determine whether an unexpected result was obvious.

> "The issue * * * is not what the patentee expected to produce but what the hypothetical person 'having ordinary skill in the art' would expect to develop if he had thought about the problem [citations omitted]. In resolving the question of obviousness, the judicial view must not include the knowledge contributed by the patentee; the teachings of his patent are irrelevant when determining what 'would have been obvious' to one skilled in the prior art before he created his 'manufacture'. [Citations omitted.]" Shaw v. E.B. & A.C. Whiting Co., 417 F.2d 1097, 1105, 163 USPQ 580, 586 (2 Cir. 1969).

And as reaffirmed in Carter-Wallace, Inc. v. Otte, 474 F.2d 529, 540, 176 USPQ 452 (2 Cir. 1972), it is also to be "kept in mind that such things [chemical compounds] must be evaluated not alone by the degree of change but also by reference to the purpose sought to be accomplished," quoting from Schering Corp. v. Gilbert, 153 F.2d 428, 431-32, 68 USPQ 84. 86-88 (2 Cir. 1946). That principle is equally applicable here, for metallurgy is but the chemistry of metals.

The overriding purpose sought to be accomplished by the patentees was to develop a flame spray powder that would self-bond as sprayed, as did molybdenum wire, that would overcome the latter's disadvantages, and that would provide for sprayed coatings the superior oxidation resist-

ance and other qualities molybdenum lacked. That this was in fact accomplished by the patented powders is shown by their immediate commercial success upon introduction to the trade. During the first full year of sale over 50,000 pounds of the Metco 404 powder were sold and eventually it replaced molybdenum wire to a large extent. Not only did the nickel-aluminum material displace molybdenum in existing flame spraying utilizations; it also opened up new areas of application where the sprayed part was to be used at elevated temperatures, as for example in the aerospace fields. While not controlling on the issue of patentability, such conspicuous commercial success in a highly technical and skilled field is a strong indication that the patented flame spray materials constituted a significant, unexpected and unobvious improvement in the art. See International Nickel Co. v. United States, 175 USPQ 209, 213 (Ct. Cl. 1972).

On the evidence before the court—much of it of ante litem motam and documented character—the conclusion is inescapable that the flame spray materials described in the '515 patent constituted not only a "new and useful * * * composition of matter" but also one which would not "have been obvious at the time the invention was made to a person having ordinary skill in the art." 35 U.S.C. §§101, 103.

Plaintiffs' final argument that the patents simply claim a new "use" for "old" materials is therefore unavailing. They ignore the fact that the invention is not merely a combination of familiar elements, i.e., nicked and aluminum powders. It is the manner of their relationship—the "composite" form—which produces the new and unexpected result of self-bonding and makes the combination greater

than the sum of its parts. None of the prior art patents claim or disclose an equivalent result.

The situation here is not unlike that in Shaw v. E.B. & A.C. Whiting Company, supra, where the invention consisted of an artificial filament manufactured from thermoplastic polymer, a very familiar substance. Such filaments were adaptable for brush and broom bristles and could be readily produced in various shapes by passing them through an extrusion die having an orifice of the desired configuration. Shaw obtained a patent on a cruciform or Y-shaped filament which not only gave it a high degree of stiffness and reduced production costs, but also a desirable linear orientation of the polymer molecules in the filament. Prior patentees of different shaped polymer filaments had indicated that linear orientation could not be accomplished by forming dies.

The court of Appeals in reversing the district court's contrary conclusion held that Shaw's filament was both novel and unobvious. The court noted that "[t]he district court failed to evaluate the problem posed by the prior art and appears to have relied on the proposition that, as Shaw's solution to the problem seemed a simple one, his filament was an obvious outgrowth. The simplicity of an invention or an improvement thereof is not, however, the test of its obviousness."

Painstaking review of the extensive fire wrapper history of the patents in suit persuades the court that plaintiffs have done little more than repeat every argument made by a series of examiners during the patent prosecution, which eventually resulted in the issuance of the patents in suit. This included the oft-repeated argument that

the invention was obvious in light of the prior art. As Metco points out, the normal presumption of patent validity under 35 U.S.C. §282 is enhanced in such a situation. Rich Products Corp. v. Mitchell Foods, Inc., 357 F.2d 176, 181, 148 USPQ 522, 525-526 (2 Cir. 1966); Georgia Pacific Corp. v. United States Plywood Corp., 258 F.2d 124, 118 USPQ 122 (2 Cir. 1958). Plaintiffs had the burden of producing clear and convincing evidence of patent invalidity and this they have failed to do.

The court finds and concludes that the invention described in the '515 patent would not be obvious to persons skilled in the art and that it taught a wholly new concept for flame spraying materials, which applied successfully—where others had failed—the principle of exothermic reaction to produce self-bonding characteristics in sprayed coatings. The '515 patent is therefore held to be valid.

In addition to the contentions already discussed, plaintiffs challenge the validity of the '248 patent on the further ground that the claims, n. 3 supra, are unpatentable as a matter of law. Relying on In re Kanter, 399 F.2d 249, 158 USPQ 331 (C.C.P.A. 1968), plaintiffs argue that the flame spray process referred to in Claim 1 of the '248 patent is acknowledged in the specifications to be the "conventional" process for applying a metal coating to a surface. Plaintiffs maintain that under Kanter to support patentability, the process itself must be novel and unobvious. Any "unique" qualities of the coating, they argue, inhere in and result from the flame spray material, not the spraying process.

While the argument has surface plausibility, a close reading of Kanter makes clear that the language plaintiffs

rely on was applied to a totally different situation. The invention disallowed in that case consisted of "the process of forming an adherent, silicon-containing coating ('case') on ferrous metal articles." 399 F.2d at 250. Kanter's claims had been allowed by the Patent Office on the new and unobvious "product" he had discovered, namely, a silicon-containing case which did not separate from its iron or steel core as a result of spalling. As the court noted, "[Kanter] has achieved this new product by performing an old process on a starting material, or base metal alloy, not previously used in the process. * * * Selection resulted in a new, useful, and unobvious product on which claims have been allowed but it did not, in our view, result in either a new or unobvious process." 399 F.2d at 251, 158 USPQ at 333. The "starting material" referred to, however, unlike the powders here, was really the end product itself; i.e., the patentable discovery consisted of Kanter's recognition that spalling did not occur when the core article on which the coating was formed had a stable body centered cubic crystal structure.

Here, the '248 patent in Claim 1 is directed to "the improvement [in the flame spray process] which comprises passing the heat-fusible material into said [heating] zone in the form of a composite comprising at least two distinct components unalloyed together as a single alloy and in proportion and form sufficient to exothermically react with each other at the temperature developed in the heating zone. * * *" PX 12. A "new and useful improvement" of a process is, of course, patentable. 35 U.S.C. §101. The "process" disclosed in the '248 patent is not simply the operation of a flame spray gun but the application of a

coating in a manner which will cause it to self-bond as sprayed to the surface being coated.

In Application of Kuehl, 475 F.2d 658, 177 USPQ 250 (1958), the Court of Customs and Patent Appeals held in an analogous situation that the patentability of a process in these circumstances must, under 35 U.S.C. §103, be judged as a whole, which includes the unobviousness of a separately patented component of the process. Id. at 663, 177 USPQ at 253-254. In Kuehl a patent had been granted on a novel zeolite composition but claims directed to a hydrocarbon conversion process involving the use of the zeolite as a catalyst to crack hydrocarbons had been rejected on the ground of prior art disclosing the use of similar zeolite catalysts.

Pointing out that the novel catalyst produced a result in the claimed process that was not predictable until Kuehl had made his invention, the Court held it was error for the Examiner to require a separate showing of unexpected results from the process as distinguished from the catalyst itself. Holding that "it was not necessary to show unexpected utility in order to show unobviousness," the Court concluded:

> "[I]t is in the public interest to permit appellant to claim the process as well as the product. The result is to encourage a more detailed disclosure of the specific methods of using the novel composition he has invented in order to have support for the process claims." 475 F.2d at 666, 177 USPQ at 256.

This is the very situation presented here.

Applying the Kuehl standard, the '248 patent was properly granted and is held to be valid, especially when the

claims were separately filed at the direction of the Patent Office. The process patent does not increase the scope of patent protection, since the patentees would under the '515 patent have the right to exclude others from making, using or selling the flame spray materials disclosed.

We now turn to the question of whether or not the plaintiffs' accused powders are in fact virtual duplicates of the nickel-aluminum compositions disclosed in the patents in suit.

Infringement

On its counterclaim for infringement, Metco had the burden of proving that plaintiffs' accused powders infringe the patents in suit. Philip A. Hunt Co. v. Mallinckrodt Chemical Works, 72 F.Supp. 865, 873-75 USPQ 122, 129 (E.D.N.Y. 1947), aff'd on other grounds, 177 F.2d 583, 83 USPQ 277 (2 Cir. 1949); Olsen v. United States Gypsum Co., 205 F.Supp. 268, 273 (E.D.N.Y. 1960); Deere & Co. v. Sperry Rand Corp., 322 F.Supp. 397, 398, 168 USPQ 150, 151 (E.D. Cal. 1970).

Metco's position basically is that the burden is met by plaintiff Eutectic's concession that its Exotec powder is substantially identical in composition with Metco's 450 powder, and the further stipulation that Exotec and plaintiff Metallizing's Moguloy M-55 are identical, that Xuper-Bond is virtually identical with Exotec except for a small amount of undisclosed additive, and that Durotec consists of 10% of Exotec and 90% of a nickel-based self-fluxing alloy. Tr. 257, 258-61; DX CD, DX CY, p. 4.

There is no question that both Metco 450 and Exotec are composed of core particles of nickel coated with finely

divided aluminum powder in a phenolic binder, and in the same proportions of approximately 5 weight percent aluminum and 95 weight percent nickel. Metco maintains that Exotec and Moguloy M-55 are made and used precisely in accordance with Example 31 found in both the '515 and '248 patents. PX 11, col. 13, PX 12, col. 13. It points to the fact that Exotec is labelled as a "Self-reacting composite powder for bond coat" and that Moguloy is described as a "Nickel-Aluminum SELF-BONDING POWDER." DX KH, DX KK.

The difficulty with Metco's position on infringement is that Example 31 calls for a materially different composition of nickel and aluminum than the 95-5 formula employed in its 450 product and the accused powders. The standard for gauging infringement is not a product made by the patentee allegedly under the patent but the language of the claims themselves as they may fairly be interpreted by resort to clarifying descriptions found in the specifications and drawings. See Maclaren v. B.I.W. Group Inc., F.2d (2 Cir. 1976), slip op. 3777 at 3785-86. The four claims in issue, n. 3, supra, do not spell out specific component proportions; one must look to the specifications and examples for such information. Thus Example 31 describes a flame spray powder consisting "of approximately 15 weight percent aluminum and 85 weight percent nickel" (PX 11, col. 13, lines 74-75)—a significant difference in proportion, which goes to the very heart of Dittrich's claimed invention. Metco's own 450 powder does not conform to Example 31 propostions nor is it within the scope of the claims in issue when read in light of the specifications defining the nature of the invention.

Three of the four claims in issue—claim 4 of the '515 patent and claims 1 and 4 of the '248 patent—use the term "composite" in describing the novel flame spray material claimed. Claim 14 of the '515 patent does not. It is that claim which Metco relates to Example 31 in contending that plaintiffs' accused powders infringe.

Claim 14 of the '515 patent, which omits the term "composite," reads as follows:

> "14. A flame spray powder in the form of individual clad particles comprising a nucleus of nickel and a coating layer of finely divided aluminum particles bound to the nucleus with a binder and characterized by the ability of generating heat during flame spraying which aids in bonding to the surface being sprayed." PX 11, col. 16.

Metco contends that plaintiffs' accused Exotec, Xuper-Bond and Moguloy M-55 powders are produced exactly in accordance with Claim 14 to achieve the same purpose and effect set forth in the patents.[29] Since no component proportions are specified, Claim 14 read literally would cover the 95% nickel-5% aluminum accused powders.

Claim 14, however, cannot be read literally without destroying the essence of the invention claimed. The invention did not consist of pasting smaller particles of aluminum powder on larger particles of nickel powder. Indeed, the patentees were denied a patent they sought on the process of coating one metal powder with an adhesive binder and then coating other metal particles with the sticky particles. See PX 4, pp. 69-70, 75-76. Such a coating

29. Defendant's Post-Trial Brief, p. 2.

process was old even before Hensel (1945), supra p. 29. If binding particles of different metals together with an adhesive film was all there was to the patentees' invention, Claim 14 would clearly have been anticipated and invalid. But, as already noted, and stressed by the patentees throughout the prosecution, the critical factor and essence of the invention was the predetermined relationship between the component metals which brought about the exothermic reaction during spraying and generated surplus heat through the formation of an intermetallic compound, thereby enabling the sprayed material to bond to the substrate.

The gist of the invention is summed up in the term "composite" as carefully defined by the patentees in the patent specification. Their definition reads as follows:

> "The term 'composite' as used herein is intended to designate a structurally integral unit and does not include a mere mixture of components which may be physically separated without any destruction of the structure. Thus, in the case of powder, the term 'composite' does not include a simple mixture of individual granules of the separate components, but requires that each of the individual granules contain the separate components which will exothermically react, forming intermetallic compounds." PX 11, col. 2.

Metco, in resting its infringement claim on Claim 14, would have the court read it without reference to the definition of "composite," although the three other claims in issue contain that term. While patent specifications cannot be used to expand the reach of the claims, "it is fundamental that claims are to be construed in light of the

specifications and both are to be read with a view to ascertain the invention." United States v. Adams, 383 U.S. 39, 48-49, 148 USPQ 479, 482-483 (1966). Moreover, even though "a patentee may be his own lexicographer * * * [h]e should not be allowed to stretch his words so that they are inclusive when infringement is being considered and restricted and narrowed when validity is challenged by disclosures of the prior art." Chicago Steel Foundry Co. v. Burnside Steel Foundry Co., 132 F.2d 812, 814-15, 56 USPQ 283, 285-287 (7 Cir. 1943).

Claim 14 of the '515 patent when read in light of the definition of "composite" and other statements of the patentees in the specifications makes it very clear that the formation of intermetallic compounds was an integral means of generating the additional heat needed to produce the self-bonding effect. This essential element of the claimed suit simply cannot be dismissed, as Metco contends, as mere "theory of the invention."[30] The very introduction of the patents begins with the sentence "This invention relates to the flame spraying of exothermically reacting *intermetallic compound* forming composites." (Emphasis supplied.) PX 11, col. 1. Further on in the specifications the patents instruct that "[a]s the components, any two metallics which may be melted together to form an *intermetallic compound* in an exothermic reaction may be used." PX 11, col. 3, emphasis supplied. The importance of intermetallic compound formation is further apparent from the specification requirement "that the intermetallic compounds formed therefrom [i.e., the component metals] liberate the required amount of heat in the intermetallic com-

30. Defendant's Post-Trial Brief, pp. 13-17.

pounds-formation and are suitable as components of a spray coating." PX 11, col. 3. Finally, the specifications note that "while the components are preferably present in the stoichiometric[31] proportions required for the formation of the intermetallic compounds, it is, however, possible to also have an excess of one or the other provided the relative amounts are sufficient to release the quantities of heat indicated above *in the formation of the intermetallic compounds.*" PX 11, col. 3 (emphasis supplied).

Example 1 of the patents makes clear that at least 10% by weight of the aluminum powder component is required with the balance of nickel powder to accomplish the formation of an intermetallic compound in accordance with the teachings of the patents. No lesser amount of aluminum appears anywhere in the patents and, indeed, larger proportions are specified, i.e., 15 weight percent aluminum and 85 weight percent nickel, in Example 31 upon which Metco relies to establish infringement. The claimed infringing powders, however, contain no more than 5% aluminum with the balance being largely nickel except for minor additives. This is also true of Metco's 450 nickel-aluminum powder.

Aside from patent terminology, the evidence at trial convincingly established that the formation of an intermetallic compound as a heat generating mechanism could not be accomplished when only 5% by weight of aluminum powder is used, as in the case of the accused powders. As explained by plaintiffs' expert, Dr. Grant, the constitution

31. "Stoichiometric" is defined as "characterized by or being a chemical composition of definite proportions by weight * * * [or] a proportion of substances or energy exactly right for a specific chemical reaction with no excess of any reactant or product. * * *" (Webster's Third New International Dictionary (1971) at 2248.

of binary alloys such as aluminum-nickel under varying conditions of relative proportion and temperature has been the subject of close metallurgical study and analysis. The results have been published in widely accepted treatises, such as PX 66, and illustrated in a phase diagram relied on generally by metallurgists. PX 66-A. In order to obtain an exothermic reaction between nickel and aluminum which will produce the intermetallic compound nickel aluminide, Dr. Grant testified, it is necessary to have at least 10% aluminum in the starting material.

That proportion is not only the minimum reflected on the phase diagram, PX 66-A, but is also consistent with the proportions designated in the patents in suit and Dittrich's 1963 paper, which leaves no doubt that a bonded nickel aluminide coating was the desideratum sought by the patented invention. PX 40. As Dittrich there pointed out, "[t]he formation of the nickel aluminides from the chemical combination of nickel and aluminum is accompanied by the release of considerable heat." PX 40, p. 493. Dittrich was, of course, then speaking of the nickel-aluminum composite powder illustrated in Fig. 1 of the '515 patent—an aluminum core surrounded by a sheath of nickel—in which the aluminum content was 16 to 18% by weight as described in Example 1. PX 11, col. 6.

When only 5% aluminum is used, Dr. Grant testified, the resulting reaction falls outside the range of intermetallic compound formation, as illustrated on the phase diagram, and heat is generated by an oxidation reaction. The patents in suit expressly distinguish the patented "composites" from "materials in which heat is generated by a reaction, such as an oxidation reaction, in which a foreign and non-metallic element is introduced. * * *" PX 11, col. 6. Al-

though, as Dr. Grant explained, the reaction between aluminum and oxygen is also exothermic in nature, an end result is not only the generation of intense heat, up to 400,000 calories, but also the production of aluminum oxide. Dittrich, the co-patentee, corroborated Dr. Grant by agreeing that if the heat-generating mechanism is an exothermic oxidation rather than intermetallic, then it is not within the terms of the patent. Tr. 1172. His view of the nature of the invention was in accord with statements in the final '515 patent application pointing out that "proportions which will not so react [i.e., to form an intermetallic compound] are, of course, not included within the scope and terminology of the claims." PX 5, pp. 70-71.

Metco sought to avoid these patent limitations and overcome plaintiffs' evidence by attempting to show that nickel aluminide—a compound which could only be formed by an intermetallic exothermic reaction—was in fact present in an Exotec sprayed coating.

During trial, Metco's Dr. Ingham had flame sprayed a mild steel panel with Exotec powder, using plaintiff Eutectic's Rototec gun. The sprayed panel, DX LF, was subjected to an x-ray diffraction examination by Metco's expert, Dr. Benjamin Post.[32] The results of the x-ray scan

32. Dr. Post is Professor of Physics and Chemistry at the Polytechnic Institute of New York and holds his Ph.D. degree in chemistry from that institution (formerly Polytechnic Institute of Brooklyn). One of his major fields of interest is x-ray diffraction. He is a member and has held office in such professional associates as the American Crystallographic Association, American Physical Society, American Chemical Society and the American Association for the Advancement of Science. Either alone or with others he has authored some 89 publications in scientific journals dealing with the structure of metallic and chemical compounds. His qualifications are more fully set forth in DX JA.

were recorded on a stylus graph, DX LG. Interpreting the tracings on the graph, Dr. Post testified he observed the indicia of three elements in the test coating: nickel, aluminum oxide and "a distorted nickel lattice, which is definitely—contains some reaction product." Tr. 1301. In his opinion, the reaction product was "an aluminide of nickel." Tr. 1304. That opinion lost considerable force, however, when Dr. Post later stated that the Ni_3Al composition he saw on the graph did not have "too much meaning" because the sprayed test panel did not conform to "academically approved procedure." Tr. 1305-06. Moreover, he was unable to quantify the nickel aluminide he described other than to say it was a "small amount." Tr. 1345.

The vulnerability of such testimony became all the more apparent from an ante litem engineering report by Frank N. Longo, a Metco research engineer. PX 43. That report, copyrighted 1970 and entitled "Metallurgy of Flame Sprayed Nickel Aluminide Coatings", endeavored to supply answers to the nature of the coating structure and its bond to the coated surface. The study reported both metallographic examination of sprayed coatings and x-ray diffraction studies. With respect to the latter, Longo's conclusion was that "x-ray analysis cannot distinguish between Ni, Ni_3Al or the solid solution of aluminum in nickel." PX 43, p. 4. His ultimate conclusion was that Metco's own 95-5 powder, Metco 450, formed a relatively soft coating containing approximately 90% nickel and nickel/aluminum solid solution with only "minor percentages of non-stoichiometric nickel aluminum NiAl." The remainder of the coating contained amorphous oxides of

nickel and aluminum. This was to be contrasted with the composition of the patented 404 powder in which the sprayed coating contained identifiable nickel aluminide and combined non-stoichiometric nickel-rich NiAl ranging from 70 to 90%, the remainder being oxides of nickel and aluminum. Id. at p. 7.

Metco also attempted to discredit plaintiffs' aluminum oxidation proof as being in effect a mere "theory" devised solely for purposes of this litigation. In support of that argument, Metco pointed particularly to Appendix V of the Patel report, PX 15, dated November 7, 1973, in which the author discussed experimental evidence for the "*proposed* Al_2O_3 *theory* of Ni/Al powder bonding [emphasis supplied]", as indicative of its post litem character. Other claimed admissions of plaintiff Eutectic's personnel are said to be found in Eutectic's U.S. patent No. 3,471,310 (1969), DX IY, and in a 1972 application for a patent filed by Patel and Eutectic's technical vice president, Joseph Quaas, DX CS.[33]

Eutectic's 1969 patent undeniably contains the statement that the use of a "resin type" coating on the powder particles disclosed in the patent "greatly diminishes the oxidation of such powders" as they pass through the torch flame. DX IY, col. 2, lines 36-46. But it does not prove that exothermic oxidation is not the heating mechanism. Nor does a fair reading of the 1972 patent application, in which Eutectic sought protection for its XuperBond material, prove that "prior art" 95-5 nickel-aluminum powders—presumably referring to Metco 450 and Exotec—

33. Defendant's Post-Trial Brief, p. 18.

generated heat by means of intermetallic exothermic reaction.

At all events, whatever inferences may permissibly be drawn as to the credibility of the defending parties' position, they are unavailing unless the party having the burden of proof—here Metco—comes forward with some solid proof supporting its infringement claim. Claimed deficiencies in the plaintiffs' denial of infringement cannot be relied on to repair obvious weaknesses in Metco's case. Those weaknesses appeared in other Metco exhibits and testimony at trial. For example, DX BK and DX BL were introduced to show Eutectic's early interest in testing Metco's 450 powder, but they also tended to confirm the inability of the testing engineers to detect any nickel-aluminum intermetallic compound in the tested specimens. Again, Metco criticized Dr. Grant's reliance on the phase diagram as support for his opinion that intermetallic compounds could not be formed with only 5% aluminum in the powder. Dr. Post, however, acknowledged that the phase diagram was indeed a useful guide not only in the laboratory but in industry as well in determining whether or not an alloy could be formed and the nature of its structure. Tr. 1312. The use of this same phase diagram was referred to by Longo in his study. PX 43, p. 1.

Such proof would be more likely to persuade a trier of the fact that the 95-5 powder composition formed a coating which was quite different from that of the 404 powder and accomplished its bond effect by a different means. In any event, it would not persuade a trier of the fact that Metco had sustained its burden of showing differently. This is especially so when Longo's study points out that metal-

lographic examination of unetched coatings formed by Metco 450 "show none of the characteristic gray and blue colors indicative of non-stoichiometric NiAl. Microhardness verifies the absence of NiAl. * * *" PX 43, p. 4.

Nor is the balance of proof tipped in Metco's favor by Dr. Ingham's calorimetric tests which purported to demonstrate that in an atmosphere free of oxygen the plaintiffs' accused powders reacted together exothermically and not by oxidation. Such tests cannot be regarded as proof positive, however, in view of Dr. Grant's testimony that enough oxygen would be contained in the oxide layer on the nickel and in the moisture content in the heating furnace to produce an oxidation reaction equal to the reaction illustrated on Ingham's chart. Tr. 2184, 2187-88.

The shortcomings in Metco's proof of infringement are obvious. They cannot be remedied by arguing that it is the self-bonding result which matters, not the technical nature of the exothermic reaction which brings it about. Such a contention runs squarely afoul of fundamental principles recently reaffirmed in Maclaren v. B.I.W. Group, supra. While patent claims may be construed in light of the specifications "the scope of protection granted by a patent is defined by the language of its claims rather than by its title, specifications, exhibits or by the commercial embodiments of the claimed invention." Id. at slip op. p. 3785.

The term "self bonding" is nowhere to be found in the claims in issue here and thus such a result cannot itself be the subject of a patent monopoly. The accused powders cannot be held to infringe simply because they self-bond. It was incumbent on Metco to show by a preponderance of

evidence that they achieved that result "in substantially the same way" as taught by the patents. Sanitary Refrigerator Co. v. Winters, 280 U.S. 30, 42, 3 USPQ 40, 44-45 (1929). This Metco failed to do for the reasons previously noted.[34] The accused powders are therefore held not to infringe the claims in suit.

Judgment is directed declaring that the patent claims in suit are valid as construed herein but are not infringed by plaintiffs' accused powders, and dismissing defendant's counterclaim on the merits. Submit proposed forms of judgment on notice.

---

34. The court has noted but rejects Metco's suggestion that former Metco employees, including Mahesh S. Patel, see DX DT, DU, who later entered the employ of plaintiff Eutectic, brought with them knowledge of the patented flame spray materials in violation of their secrecy agreements with Metco and thus paved the way for the claimed infringement. Also considered was Metco's attack upon the credibility of Dr. Grant. Even though the court did not accord great weight to Dr. Grant's views concerning the prior art, his expertise in the field of metallurgy was beyond question and the substance of his testimony far more consistent with other evidence than that of Dr. Post.

Appendix B

Opinion of the United States Court of Appeals for the Second Circuit
Timbers and Van Graaferland, Circuit Judges, and Owen, District Judge
(Opinion written by Judge Owen)

COURT OF APPEALS

SECOND CIRCUIT

EUTECTIC CORPORATION, *et al.*

v.

METCO, INC.

Nos. 76-1490 and 76-7514

Decided Feb. 6, 1978

This is an appeal from a determination of the District Court for the Eastern District of New York, reported at 418 F.Supp. 1186, 191 USPQ 505 (1976), that certain patents are valid but not infringed. The patents are two and involve the art of spraying various bi-metallic composites from a flame spray gun onto a metal surface, much as paint is sprayed. United States Patent No. 3,322,515 (the '515 Patent) covers the flame spray materials in powder or wire form.[1] No. 3,436,248 (the '248 Patent) covers the

1. Many different pairings of metals are set forth as achieving the desired self-bonding effect, with varying bonding strengths being achieved by different percentage relationships of the metals.

process of spraying the materials described in the '515 Patent.

The patents teach the artisan that various specified pairings of metals (e.g., nickel and aluminum) prepared and sprayed under appropriate circumstances, will cause a firm, self-bonding coating upon an unprepared metal surface. Essential to this result, the patents teach, is the generation of a certain minimum amount of additional heat during the spray flight. This is caused by the two metals —already heated to a reaction point by the flame spray gun —thereafter interracting to form intermetallic compounds, and, in the process, giving off heat. The artisan, according to the patents, may vary the proportions in the various pairings according to what is desired as the coating, so long as the proportions selected produce the required additional heat in spray flight. There are standard metallurgical diagrams to which proportions will produce the required heat and which will not, and the '515 Patent provides some examples.

Only one spray powder, consisting of essentially 95% nickel and 5% aluminum by weight, is involved here because of its substantial commercial success. Each particle of the fine powder has a nickel nucleus surrounded by even finer aluminum particles bound to the nucleus by resin.[2]

Plaintiffs are the claimed infringers. They are the Eutectic Corporation and New Metals Corporation, manufacturers of products in this general field, and Metallizing Company of America, a manufacturer and seller of flame spraying equipment and a purchaser for resale of Eu-

2. Certain of the powders in suit have small amounts of additives. These additives have no relevance to the issues before us.

tectic's powders. Plaintiff Eutectic markets flame spraying powders under the trade names "Exotec," "Xuper-Bond," and "Durotec." Plaintiff Metallizing markets Eutectic's powder as "Moguloy M-55."

Defendant Metco, Inc. is the owner of the patents in question, and markets its successful "Metco 450" thereunder. It is conceded that the Eutectic and Metallizing powders are nickel-aluminum compositions substantially identical to the Metco "450" powder.[3]

Plaintiffs in this action sought a declaratory judgment of non-infringement and invalidity of the patents.[4] Defendant Metco counterclaimed, charging infringement by each plaintiff.[5] The District Court found validity, but concluded the patents were not infringed. All parties have appealed.

The history of this field is instructive. Flame spraying of metal onto a metal surface is usually accomplished by placing flame spray material in either rod, wire or powder form into a flame spray gun in which, by gas-oxygen reduction or electric arc flame, it is reduced to a molten or semi-molten state and thereupon propelled onto the surface to be coated. From the turn of the century to the 1940's, the only practicable method of assuring some degree of bonding between the coating and the surface was to me-

3. Obviously, if the District Court's conclusion of non-infringement by the plaintiffs is correct, Metco's own "450" is not within its own patents.

4. This litigation had its beginnings in the Northern District of Illinois in an action by Metco against Metallizing because of the latter's sale of "Moguloy M-55."

5. Jurisdiction is based upon the patent laws of the United States. 28 U.S.C. §1338.

chanically roughen the surface to provide crevices and undercuts into which the sprayed molten particles would enter, forming a mechanical interlock. In the mid-1940's, a substantial advance was achieved when one Arthur P. Shepard, a Metco engineer and deceased co-patentee of the patents in suit, discovered that molybdenum, when used as a flame spraying material, would self-bond on a clean unprepared surface. Shepard was granted a patent thereon.

For the next fifteen years molybdenum wire was the only widely-used material in the flame spray field, notwithstanding a number of disadvantages. It was difficult and messy to use, caused wear on equipment because of its hardness, could only be applied at a relatively slow spray rate, would not satisfactorily bond to certain surfaces, required a high degree of operator skill, and could not be used where the part being sprayed would subsequently be subjected to use at temperatures above 600 degrees, at which the molybdenum would oxidize and deteriorate, destroying the bond. Thus, there remained during those years a clear need to be filled in the flame spraying art to overcome the problems associated with molybdenum.

As events would have it, this need was also met by a Metco engineer, Ferdinand J. Dittrich, who, working under Shepard, discovered the solution in a powder, each particle having a nickel core surrounded by finely divided aluminum particles bound together by a resin. This powder, when heated to a certain temperature in a flame spray gun, would thereafter exothermically react—that is, each element would chemically react with the other, releasing additional heat during the spray's flight from the tip of the gun to

the surface being coated. This heat-creation during flight, Dittrich discovered, would cause a secure bonding even to a smooth, clean, unprepared surface. To phrase it in the approximate language of one of the claims of the '515 Patent, the powder had the ability of generating heat during flame spraying which aided in bonding to the surface being sprayed. Clearly, the key to this generation of heat was to be found in the percentage relationship of the components and the arrangement of each particle.

The plaintiffs, at the outset, attack the District Court's conclusion of patentability. They claim that all the basic elements of the Metco patents are found in the prior art. Clearly, the prior art discloses a number of elements inherent in and essential to the Metco patents such as the principles of exothermic reaction and intermetallic compound formation between certain metals. A 1958 patent to one Mackiw discloses a method of coating particles of one metal with another. Machiw's object, however, was essentially to develop an improved process for pressing or compacting metal powder into shapes difficult to manufacture by conventional casting methods, and, we note, the powders in suit were the product of Dittrich's specifications, not Mackiw's. A Gutzeit patent (1959) teaches the melting of a nickel-phosphorous composite in a flame spray gun but merely speaks of spraying "the resulting melt" upon a metal surface.

What the prior art does *not* teach is how, with conventional flame spray equipment, a coating can be made to self-bond to a clean, smooth metal surface through the use of strting materials capable of causing an exothermic reaction in the spray stream releasing further heat to aid in the

bonding. It is, therefore, the creation of certain additional heat in the spray flight that is unique and is at the heart of Dittrich's invention. Thus, the specific materials and their use as disclosed are clearly a "new and useful . . . composition of matter" in their distinctive arrangement, function and end result, and therefore patentable under 35 U.S.C. §§101, 102. The conclusion of the court below to this effect was thoroughly supported by the evidence. 418 F.Supp. at 1196-1201, 191 USPQ 514-519.

Plaintiffs next assert the "obviousness" of the alleged invention to defeat the patent. See U.S.C. §103. The court below, however, put the question well: "Would it have been obvious to those [skilled in the art of flame spraying] that the formation and flame spraying of nickel-aluminum powders as taught in the patents in suit would produce a self-bonding coating on a metal substrate that had not been heated or otherwise treated to receive it?" The court found that it was not, and we agree. After fifteen years of less than satisfactory experience with molybdenum, Dittrich was the first to recognize, develop and adapt the concept of coated or clad powder particles for use in flame spraying to achieve a self-bonded surface coating without prior preparation of the substrate. Further on the question of obviousness, the court below noted that "[t]he overriding purpose sought to be accomplished by the patentees was to develop a flame spray powder that would self-bond as sprayed, as did molybdenum wire, [and] that would overcome the latter's disadvantages. . . ." That this was in fact accomplished by Metco's powder was shown by its immediate commercial success upon introduction to the

trade. During the first year, over 50,000 pounds were sold and eventually it replaced molybdenum wire to a large extent.[6] The court below correctly concluded that the patent flame spray materials constituted a significant, unexpected and unobvious improvement in the art. 418 F.Supp. at 1201-07, 191 USPQ 518-24. This finding is amply supported by the record.

We affirm the well-reasoned determination of the court below that the patents are valid.

We next turn to the District Court's conclusion of non-infringement. The court below held that Metco had not met its burden of proof on the issue of infringement, and this conclusion was clearly based on the court's factual finding that if the flame spray powder contained less than 10% aluminum by weight, there would be no formationn of an intermetallic compound as a heat-generating mechanism in accordance with the teaching of the patent. Consequently, the plaintiffs' 5% aluminum powders were necessarily non-infringing.[7]

In reaching this conclusion, the court below recognized, and it is without dsipute, that the claimed infringing powders, while having but 5% aluminum, do fall squarely within Claim 14 of the '515 Patent, which reads as follows:

> A flame spray powder in the form of individual clad particles comprising a nucleus of nickel and a coating layer of finely divided aluminum particles bound to the nucleus with a binder and characterized by the abiltiy of generating heat during flame spraying which aids in bonding to the surface being sprayed.[8]

However, the court, on the basis of certain examples in the '515 Patent[9] and its understanding of the appropriate metallurgy, read into Claim 14 a requirement of at least 10% aluminum by weight. While we agree with the court below that it is appropirate, in certain circumstances, to refer to other portions of the patent to understand and define its boundaries, United States v. Adams, 383 U.S. 39, 148 USPQ 479 (1966), we disagree with its finding that a minimum of 10% aluminum by weight is required to generate heat by means of an exothermic reaction between the nickel and aluminum in the formation of an intermetallic compound.

Essential to the determination of the necessary percentage of aluminum required for the appropriate production of heat is a certain phase diagram, which read together with an associated graph, shows the amount of heat released by interaction of nickel and aluminum throughout the entire

6. Commercial success, while not controlling, is an indication of significant and non-obvious improvement in the art. See International Nickel Co. v. United States, 175 USPQ 209, 313 (Ct. Cl. 1972). See also Maclaren v. B-I-W Group Inc., 535 F.2d 1367, 1376, 190 USPQ 513, 520 (2d Cir.), cert. denied, 429 U.S. 1001, 192 USPQ 121 (1976).

7. In this regard the court took note of some expert testimony that while there would be an exothermic reaction in the spray stream, it would be an oxidation reaction between the aluminum and oxygen in the air, and that only nickel would be deposited on the spray surface.

8. The court below also found the essence of the '515 Patent to be—and there is no question that the alleged infringing powders are—starting materials capable of generating an exothermic reaction releasing heat during the spray flight to cause a bond upon the receiving surface. We agree with this and also agree that one must focus primarily upon the initial composition of the powders in question rather than upon the composition of the coating after spraying.

9. No examples spoke of less than 10% aluminum, and some spoke of more.

spectrum of percentage relationships, whether stoichiometric[10] or non-stoichiometric. The court below properly found the phase diagram to be one relied on generally by metallurgists, and therefore to govern. However, relying upon an unresponsive and conseqently misleading aswer of one Dr. Nicholas Grant, an expert for plaintiffs,[11] the court below erroneously concluded from the diagram that a minimum of 10% by weight of aluminum was required for there to be any interaction resulting in the formation of an intermetallic compound releasing the necessary heat. However, examination of the phase diagram itself reveals that there was confusion below between weight and atomic percentages and that, in fact, according to the diagram, such an effect will occur with only 5% aluminum by weight.[12] It is unquestioned that the patents speak in terms of the *weight* of the components, not the atomic percentages. Indeed, at later points in the trial, Dr. Grant conceded that 5% *by weight* according to the phase diagram could not only cause a reaction releasing more than the minimum

10. "Stoichiometric" is defined as "characterized by or being a chemical composition of definite proportions by weight . . . [or] a proportion of substances or energy exactly right for a specific chemical reaction with no excess of any reactant or product . . . ." Webster's Third New International Dictionary 2248 (1961).

11. "Q. And what percentage of aluminum is necessary according to the phase diagram in order to obtain an intermetallic type reaction?

"At least 10 percent, and preferably 15 or more percent if you want to get a significant heat output, due to the formation of an intermetallic exothermic reaction." Joint Appendix at JA 139.

12. The error below stemmed from the fact that the diagram has two scales along the horizontal axis, one at the bottom for atomic percent and one at the top for weight. Ten atomic percent of aluminum (to 90 atomic percent nickel) is slightly less than 5% aluminum by weight.

requirements of heat[13] but also, form some intermetallic compound.[14]

Unquestionably, when the decision of the court below rests upon an incorrect reading of an undisputed document, this court is free to substitute its own reading of the document. Orvis v. Higgins, 180 F.2d 537, 539 (2d Cir.), cert. denied, 340 U.S. 810 (1950). Upon a thorough consideration of the record, including Dr. Grant's own testimony as to the phase diagram, the conclusion is inescapable that a

13. "Q. And so, would you conclude that the—that in this chart the 90 shown, the point 9 shown is the atomic percent?

"A. Well, yes, now that we have corroborated this.

"Q. Okay, so that it's 5 weight percent—right?

"A. We could have saved this had I been told what it was initially, instead of—

"Q. All right, so that's 5 weight percent, if we look at the charts below, we will generate 4,000 calories per gram atom, is that correct?

"A. With reference to room temperature, yes, sir." Joint Appendix at JA 272.

This testimony is significant in view of the fact that the '515 Patent states that "[t]he components should release [at least] 3,000 calories per gram atom . . . ."

14. "Q. So that according to your opinion, with five percent aluminum on the nickel surface, it is possible for the aluminum to start to react with the surface of the nickel exothermically and form into a intermetallic compound?

"A. Yes, it may form a thin film of it. Yes, sir." Joint Appendix at JA 284.

Dr. Grant, plaintiff's expert, then went on to state emphatically that the intermetallic compound thus formed would probably be lost before reaching the surface by reason of the further diffusion of the aluminum, and thus no intermetallic compound would be found in the coating. However, while the '515 Patent envisions that most pairings of metals, regardless of proportions, will deposit an intermetallic coating on the surface, it nowhere asserts that an intermetallic compound must be deposited on the surface, it merely asserts that its formation is the mechanism that generates the required heat.

mistake was made in the District Court's interpretation of this key document, and that the findings and conclusions based upon it are clearly erroneous. United States v. United States Gypsum Co., 333 U.S. 364, 395, 76 USPQ 430, 442-443 (1948).

It is also apparent that the court below, in reading a minimum of 10% aluminum into Claim 14 of the '515 Patent from certain examples set forth elsewhere in the patent, was doing no more than finding what it believed to be additional support for the metallurgical conclusion it had mistakenly reached. Since the extent to which a court may look to the specifications or examples to limit the claim is to be determined on the facts in each case. In re Van Lint, 354 F.2d 674, 679, 148 USPQ 285, 288-289 (C.C.P.A. 1966), in view of what we conclude is the proper reading of the crucial phase diagram, it becomes inappropriate to treat the '515 Patent's examples as some evidence of a limitation upon Claim 14.[15]

Given all of the foregoing, we conclude that the patents clearly teach the artisan that a 95% nickel-5%aluminum powder, prepared and sprayed as described, achieves the result the patent envisions.[16] The patents teach the man-

15. Indeed, to the contrary, in one of the affidavits submitted by inventor Dittrich to the Patent Office in connection with his application, he specified combinations of nickel and aluminum in which the percentage of aluminum for a successful bond ran as low as 2.5%. Joint Appendix at E 790.

16. Dr. Grant contended that the required heat was generated either by oxidation of the aluminum or by a solid solution heat effect between the nickel and aluminum, rather than by the formation in some part of an intermetallic compound. Even if he is correct, this would not affect the ultimate disposition of this case, for as was held in Diamond Rubber Co. v. Consolidated Tire Co., 220 U.S.

(footnote continued on next page)

ner of preparation of the powder, they specify the minimum amount of heat that must be generated in flight, and the artisan, by reference to standard metallurgical charts and diagrams, can readily ascertain that a 95%-5% ratio will provide such heat. Thus, the artisan utilizing this ratio will achieve the result the patent teaches. This is unquestioned. Consequently, the plaintiffs' powders consisting essentially of 95% nickel and 5% aluminum are within Claim 14 of the '515 Patent and Claim 4 of the '248 Patent.[17] They are prepared substantially as taught; they

428, 31 S. Ct. 444, 55 L. Ed. 527 (1911): "[I]f [a patentee] has added a new and valuable article to the world's utilities he is entitled to the rank and protection of an inventor. And how can it take from his merit that he may not know all of the forces which he has brought into operation? It is certainly not necessary that he understand or be able to state the scientific principles underlying his invention, and it is immaterial whether he can stand a successful examination as to the speculative ideas involved . . . . He must, indeed, make such disclosure and description of his invention that it may be put into practice . . . . This satisfies the law, which only requires as a condition of its protection that the world be given something new and that the world be taught how to use it." Id. at 435-36, 31 S. Ct. at 447, 448, 55 L. Ed. at 532. Also applicable is Devex Corp. v. General Motors Corp., 467 F.2d 257, 175 USPQ 321 (3d Cir. 1972), cert. denied, 411 U.S. 973, 177 USPQ 545 (1973). There the defendant sought to avoid infringement by arguing that the chemical interactions that occurred during its accused lubrication process were different from those reported by the patentee. In reversing the lower court's holding of non-infringement, the court ruled: "[I]f it is directly determinable that the two lubricants have essentially the same components, are applied in the same way and that the results of their use are essentially the same, the disputation of chemists about the chemcial interactions that occurred in the processes cannot be decisive." Id. at 261, 175 USPQ at 323-324.

17. In practice, the precise ratio of the powders doubtless varies by some fraction of a percent. Such variation, however, would not alter the inescapable conclusion that powders in the range of those at issue in this case are within the scope of the patent. See International Nickel Co. v. Ford Motor Co., 166 F.Supp. 551, 558, 119 USPQ 72, 78 (S.D.N.Y. 1958).

generate the requisite heat; and they achieve the same result. They therefore infringe the defendant's patents.

The determination of the court below declaring the patent valid is affirmed. The determination of noninfringement and the award of costs to plaintiffs is reversed, and the case remanded for further proceedings not inconsistent with this opinion.

Appendix C

Section 8, Clause 8. Patents and Copyrights

To promote the Progress of Science and useful Arts, by securing for limited Times to Authors and Inventors the exclusive Right to their respective Writings and Discoveries;

Appendix D

§103. Conditions for Patentability; Non-Obvious Subject Matter

A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains.

Patentability shall not be negatived by the manner in which the invention was made. July 19, 1952, c. 950, §1, 66 Stat. 798.

§112. Specification

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor of carrying out his invention.

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

An element in a claim for a combination may be expressed as a means or step for performing a specified function without the recital of structure, material, or acts in support thereof, and such claim shall be construed to cover the corresponding structure, material, or acts described in the specification and equivalent thereof. July 19, 1952, c. 950, §1, 66 Stat. 798.

307 BAR PRESS, Inc., 132 Lafayette St., New York 10013 – 966-3906

(7300)